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THE

GARDENS' BULLETIN

STRAITS SETTLEMENTS

Volume VIII
October, 1934-October, 1935

To be purchased at the Botanic Gardens, Singapore

Published by Authority.

SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE, SINGAPORE, BY W. T. CHERRY, GOVERNMENT PRINTER.

FEB 131936



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THE

GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. VIII

10th October, 1934 Part 1

NOTES ON MALAYAN DIPTEROCARPACEAE—II.

C. F. Symington, B.Sc.

This paper continues the series commenced by my "Notes on Malayan Dipterocarpaceæ—I" published by courtesy of the Director of Gardens, Straits Settlements in this Bulletin, Vol. VII, pt. 2 (1933). As previously, the species dealt with have been selected in no systematic sequence but are those concerned in various problems that have demanded attention from time to time.

I have first discussed the genus Scaphula Parker. study of this group involved some more or less intensive work upon all our species of *Anisoptera*, the results of which

are thought to be worthy of publication.

Next I have endeavoured to clarify the position with regard to the much confused species Hopea sangal, following my notes on which a description of its close ally H. semi-

cuneata seems appropriate.

Finally I have had the pleasure of examining the dipterocarps collected in Sarawak by Mr. Richards of the Oxford University Exploration Club. Two of these collections [Balanocarpus longiflorus (Brandis) Foxw. and Hopea laxa Sym.] are of peculiar interest as they raise the whole question of the status of the anomalous genus Balanocarpus. Although I do not feel that my study of the plants concerned in this group is sufficiently complete for me to give an authoritative and final treatise upon it, it seems desirable that a statement of my opinions should be given in justification of the publication of these two new binomials.

As in my previous paper the concluding paragraph of my notes under each species occurring in the Malay Peninsula is addressed in particular to Malayan Forest Officers.

I wish to take this opportunity of recording my grateful appreciation of the invaluable assistance I have received from the Director of the Royal Botanic Gardens, Kew, Dr. Burtt Davy of the Imperial Forestry Institute, Oxford, the Forest Botanist, Dehra Dun, the Curator of the Herbarium, Calcutta, the Forest Botanist, Maymyo, Mr. Henderson of Singapore, Dr. van Slooten of Buitenzorg, the Curator of the Museum, Kuching, and the Acting Chief, Division of Botany of the Bureau of Science, Manila. I should like also to express my appreciation of the enthusiasm and interest of my colleagues in the Malayan Forest Service who are mainly responsible for the collection of recent herbarium material. Without such willing co-operation as has been accorded me, research of this nature would be impossible.

Scaphula Parker in Fedd. Rep. 30: 325 (1932).

In uniting Vatica scaphula Dyer (=Hopea scaphula Roxb.) and Anisoptera glabra Kurz, Parker (l.c.) was of opinion that this interesting species could not be assigned to any of these genera and created for it the new genus Scaphula. As the recognition of this new genus would involve the transfer to another genus of two [A. scaphula (Roxb.) Pierre and A. laevis Ridl.] from among our six Malayan species of Anisoptera, which, as far as the forest officer or timber worker are concerned, form an essentially homogeneous group, it seems desirable to examine critically the evidence put forward in support of the new genus before making the transfer.

Undoubtedly Scaphula is most closely allied to Anisoptera Korth. and the problem resolves itself into deciding whether A. scaphula and A. laevis should be removed to the new genus Scaphula or the generic conception of Anisoptera be amended to include them. Parker, fully aware of the close affinity of Scaphula and Anisoptera, has enumerated the differences between them as follows:—

		Scaphula	Anisoptera
1.	Calyx lobes	open	imbricate
2.	in bud Stamens	15-20, normally 15 those opposite the sepals paired and those opposite the petals solitary. Some or all the stamens opposite the petals may be paired with the additional stamens fully developed or more or less reduced*	20-50
3. 4.	Connectives Style	shortly mucronate slender with small 3-lobed stigma passing gradually into a stylopodium as in Dipterocarpus	long awned stylopodium stout and fleshy tipped with 3 short styles without well-differ- entiated stigmas.

^{*}The presence of 20 stamens is evidently abnormal although not surprising. I have never met with more than 15 stamens in the flowers I have examined.

One and 3 are not of great importance as generic characters. In the flowers of A. scaphula I find that the calyx lobes are actually slightly imbricate in bud. The length of the connectival appendage is a very variable character within other genera of the Dipterocarpaceae although it is normally a reliable specific character. Occasional abnormal stamens with an awn-like appendage are to be found in A. scaphula. The number of stamens also is subject to great variation within some genera of this family including the genus Anisoptera (Scaphula excl.). In A. costata, A. marginata, and A. Curtisii the number of stamens varies between 23 and 30 whereas in the flowers of A. megistocarpa examined by me there have been from 47–54 stamens.

The main diagnostic character of Scaphula is the nature of the stylopodium. Reference to the figures (Pls. I—IV) will show how Anisoptera and Scaphula differ in this respect. In Anisoptera the ovary is surmounted by an erect, fleshy, sulcate stylopodium which is crowned with 3 (occasionally 4) short styles without well-differentiated stigmas. In Scaphula the ovary is surmounted by an enlarged flattened rugose disc. From this disc a slender columnar style rises rather abruptly and is terminated by three sessile stigmatic lobes. Scaphula differs from most species of Anisoptera also in being almost glabrous and in having subglobular flower buds.

Against these differences must be considered the many characters that Anisoptera and Scaphula have in common and which are not shared by other genera in the family. The facies of A. scaphula and A. laevis is that of an Anisoptera. In form and bark characters and in the structure of the secondary xylem of the wood they agree with Anisoptera. The structure of the embryo and the germination of the seed is as in Anisoptera (vide Foxworthy, Mal. For. Rec. 10 p. 31) and they share the peculiar character of having young parts and the undersides of the leaves furnished with minute peltate scales (fugacious in A. scaphula). The fruits of Anisoptera and Scaphula are essentially the same and can be distinguished only by the persistent style and stylopodium or occasionally by persistent stamens.

Whether or not *Scaphula* is worthy of generic rank must always be to some extent problematical but the writer is strongly opposed to the disruption of so characteristic and homogeneous a group as that formed by the described species of *Anisoptera*. He is of opinion that when the genus is next monographed slight alteration should be made in

the generic definition of Anisoptera to include A. scaphula and A. laevis. Foxworthy (l. c. p. 93) has slightly altered the generic description of van Slooten [Bull. Jard. Bot. Buitenz. III, 8:3 (1926)] to embrace these species, but has not allowed for their distinctive form of style and stylopodium nor for the fact that they are practically glabrous. The distinctive characters of A. scaphula and A. laevis should, however, be recognised by placing them in a section [Sect. Glabrae Heim, Recherches sur les Dipterocarpées, p. 33 (1892)] apart from the other known species of the genus Anisoptera.

Anisoptera scaphula (Roxb.) Pierre, Fl. For. Cochinch. sub t. 235 (1890) in obs.: Hopea scaphula Roxb. Fl. Ind. 2: 611 (1832); Kurz, Prelim. Rep. For. Pegu, app. A: 19 et app. B: 29 (1875), et Fl. Brit. Burma 1: 121 & 547 (1877): Anisoptera glabra Kurz in Journ. Asiat. Soc. Bengal 42, pt. 2: 61 (1873), Prelim. Rep. For. Pegu, app. A: 16 et app. B: 29 (1875), et Fl. Brit. Burma 1: 112 (1877); Dyer in Hook. f., Fl. Brit. Ind. 1: 301 (1875); Brandis in Journ. Linn. Soc. 31: 41 (1895), et Ind. Trees 67, t. 29 (1911); Guérin ex Lecomte, Fl. Gen. l'indo-chine 1: 368 (1910); non Pierre, l.c. sub t. 235 et 253; non Ridl. in Agri. Bull. S. S. & F. M. S. 1, pt. 2: 60 (1901), et in Journ. R. As. Soc. Str. Br. 54: 25 (1910): Vatica scaphula Dyer in l.c.,; King in Journ. As. Soc. Bengal 42, pt. 2: 127 (1893) in obs.; Brandis in Journ. Linn. Soc. 31: 132 (1895), et Ind. Trees 72 (1911): Anisoptera thurifera Ridl., Fl. Mal. Penins. 1: 219 (1922); Foxw. in Journ. Mal. Br. R. As. Soc. 5: 341 (1927) partim, Mal. For. Rec. 3: 78 (1927) partim (plate of leaves and fruit), et Mal. For. Rec. 10: 100 (1932), non Blume: Scaphula glabra Parker in Fedd. Rep. 30: 326 (1932); Cretzoiu in Acta Faun. Flor. Univers. Bot. 1, 9: 3 (1933) fig. 1 & 2. Plate I.

The various descriptions published for this species under the names *Vatica* scaphula and *Anisoptera* glabra being hardly satisfactory, I have prepared the following with the help of our Peninsula collections and Burmese material kindly lent by Calcutta and Maymyo.

Branchlets usually pale yellow-brown, glabrous, sometimes covered with light brown scales. Leaves oblong, elliptic—oblong or obovate, gradually or abruptly acuminate, usually slightly cordate at base but may be rounded, truncate, or even sub-cuneate, usually about $12 \text{ cm.} \times 6 \text{ cm.}$ but varying between very wide limits, glabrous, coriaceous,

usually drying a light green-brown on both surfaces, the lower sometimes sparsely clothed with light-coloured scales: midrib depressed above, elevate and yellow beneath; secondary nerves 15-24 pairs, usually at an angle of over 60° to the midrib, curved and anastomosing towards the margins, with frequent distinct intermediary prominent and usually yellow on both surfaces; fine reticulations evident on both surfaces, more prominent beneath; petioles 2-4 cm., enlarged rugose and sulcate in upper half, frequently clothed with pale brown scales; stipules linearlanceolate acuminate, 5 mm. long (may exceed 2 cm. in seedlings), densely clothed with brown scales, caducous. Panicles axillary and terminal, pendulous, racemose, up to 20 cm. long, puberulous or densely tomentose towards the ends; ultimate branchlets distant, 1-5 cm. long, each bearing 2-7 distichous flowers about 5 mm. apart. Flowers globular in bud, slightly pointed at apex, 6 mm. long including the pedicel, foetid or sickly smelling; pedicel 1.5 mm., grey or tawny tomentose; calyx cup shallow. Sepals slightly imbricate in bud, tomentose on both surfaces, 2 large oblong obtuse, 3 smaller ovate acuminate. Petals slightly twisted in bud, reflexed when expanded, ovate-oblong, glabrous or sometimes sparsely puberulous along the margins, white, falling singly. Stamens 15 (15-20, Parker), pairs opposite the sepals, solitary opposite the petals; filaments flattened, shorter than the anthers; anthers somewhat hastate. posterior cells smaller than the anterior; appendage to connective mucronate or rarely extended into a short awn. Ovary deeply embedded in the receptacle and surmounted by a rugose, tomentose, disc-like or sub-conical stylopodium; style columnar, glabrous; stigma hardly enlarged, 3-lobed. Fruit: stalk 2-3 mm. long, rugose, puberulous; calyx tube enclosing and adnate to the nut, globose when mature, about 1.25 cm. diam., more or less verrucose, glabrous; large calyx lobes usually linear spathulate, 14 cm. × 2.5 cm. but very variable, somewhat verrucose; 3 small lobes, linear, acuminate or rounded at apex, up to 2.5 cm. long, also very variable; nut crowned with the enlarged tomentose disc-like stylopodium and erect style (a few stamens occasionally persist for a long time but have fallen before the fruit is mature). Embryo: cotyledons unequal; dorsal cot. occupying the entire upper portion of the ovary, large; placental cot. lying below the dorsal, smaller; radicle medial and horizontal.

Parker, in his notes on the genus *Scaphula*, has given an account of the early history of this interesting species which has been known in Burma variously as *Vatica scaphula* and *Anisoptera glabra*. As Parker points out,

although Kurz realised that these two species belonged to the same genus he did not realise that they are actually conspecific. Thus, although Kurz in 1877 proposed and Pierre in 1890 used the combination Anisoptera scaphula, it was not until 1932 that A. glabra Kurz was reduced to synonymy with V. scaphula Dyer by Parker. The last author, however, being (as were both King and Brandis) fully aware of the anomalous nature of the species, was not of opinion that it could remain in either of the genera to which it had previously been assigned. He recognised its close affinity to Anisoptera but considered that the floral characters were such as to warrant the creation of a new genus Scaphula. My reasons for retaining this species in the genus Anisoptera are given fully in my notes upon the genus Scaphula (p. 2).

In 1901 and again in 1910 Ridley recorded Anisoptera glabra from the Malay Peninsula but the collections examined by him were actually A. laevis Ridl., a mistake which he corrected in 1922 when publishing the description of his new species in the Flora of the Malay Peninsula. These collections, originally referred by Ridley to A. glabra, were examined by Foxworthy who, in 1911 (Phil. Journ. Sc. Bot. 6: 257), identified them with A. thurifera.

Our earliest authentic collection of A. scaphula from the Peninsula is C. F. 453 (Kew No. 32) which was collected in Plus Forest Reserve in 1912 and is the specimen referred by Ridley to A. thurifera in his flora. This collection has fruit hardly mature and is in a condition in which it is difficult to distinguish these two species.

Thus Foxworthy's A. thurifera from the Malay Peninsula was actually A. laevis while Ridley's A. thurifera was A. scaphula.

In 1927 (Journ. Mal. Br. R. As. Soc. 5: 341 and Mal. For. Rec. 3: 78) Foxworthy included under A. thurifera collections of both A. laevis and A. scaphula. This is evident from the fact that he says that "A. thurifera Bl. is the commonest species", but gives a plate of leaves and fruit based on C. F. 11685 which is A. scaphula. His former conception of the species is explained by Foxworthy in Mal. For. Rec. 10 (1932) but here, as in his previous two publications, he continues to record A. glabra Kurz as a synonym of A. thurifera (Blco.) Bl. This is quite unjustified although sterile specimens of these species are undoubtedly rather alike.

We may now say definitely that A. thurifera Bl. has never been collected in the Peninsula.

Collections examined—

BURMA: Kurz 116 & 2117 (Auth. spec. of A. glabra Kurz); King's coll. 144 & 164; Brandis 114; Calcutta Nos. 885, 952, 966, 8089, 8358 & 8397; Maymyo Nos. 6505 (Field No. 2545), 7564 (Field No. 5062) & 14146 (Field No. 11892); For Dept. Tenas. Circ. 351; Dehra Dun Nos. 1188, 5023 & 39751.

MALAY PENINSULA: KEDAH: C. F. 21735.

PERAK: C. F. 453 (Kew No. 32), 10378, 30772 & 30807.

KELANTAN: C. F. 32722. TRENGGANU: C. F. 10242. PAHANG: C. F. 2399.

SELANGOR: C. F. 9993, 11685, 14357, 22008, 22010 &

24962.

NEGRI SEMBILAN: C. F. 631.

Anisoptera scaphula is a large smooth-leaved form of mersawa not uncommon towards the north of the Malay Peninsula. It is identical with the tree known in Burma by the vernacular names of boilshara, taungsagaing, kaung humu, etc. and producing the timber known as "mascal wood". The former identification of this tree with Anisoptera thurifera of the Philippines is shewn to be wrong.

Anisoptera lævis Ridl., Fl. Mal. Penins. 1: 219 (1922); Brandis in Journ. Linn. Soc. 31: 41 (1895) (in obs. sub A. glabra); Foxw., Mal. For. Rec. 10: 101 (1932); Anisoptera glabra Ridl. in Agri. Bull. S. S. & F. M. S. 1, pt. 2: 60 (1901) et in Journ. R. As. Soc. Str. Br. 54: 25 (1910); non Kurz: Anisoptera thurifera Foxw. in Phil. Journ. Sc. Bot. 6: 257 (1911) partim, quoad spec. malay., in Journ. Mal. Br. R. As. Soc. 5: 34 (1927) partim et Mal. For. Rec. 3: 78 (1927) partim (plate of bole and bark); non Blume, non Ridl., Fl. Mal. Penins. l.c. Plate II.

The following description is prepared as an aid to comparison of this species with its very close ally A. scaphula together with which it forms a group distinct

from all other known species of the genus.

Branchlets slightly sulcate towards the ends when dry, glabrous or more or less densely clothed with reddish scales. Leaves oblong to elliptic—oblong or lanceolate, gradually or abruptly acuminate, rounded or subcuneate at base, 8–10 cm. × 2.5–4.5 cm., coriaceous, when dry green-brown above, reddish beneath owing to the more or less dense covering of scales; midrib depressed above, elevate and reddish beneath; secondary nerves 10–15 pairs at an angle of about

50° to the midrib, curved and anastomosing towards the margins with occasional distinct intermediary nerves. prominent on both surfaces, elevate beneath; fine reticulations conspicuous particularly upon the lower surface; petioles 1.5-2.5 cm., enlarged and rugose in the upper half, usually clothed with minute reddish scales: stipules lanceolate, densely squamate, caducous. Panicles axillary and terminal, pendulous, racemose, up to 18 cm. long, densely stellate fulvous tomentose towards the ends of the branchlets; ultimate branchlets distant, up to 2 cm. long. each bearing 2-8 closely set distichous flowers. Flowers globular in bud, pointed at the apex, 5 mm. long including the pedicel; pedicel rugose, 1.5 mm., fulvous tomentose; calyx cup shallow. Sepals valvate, 2 oblong obtuse, slightly larger than the remaining 3 which are deltoid acute, all fulvous tomentose on both surfaces. Petals slightly twisted in bud, reflexed when expanded, oblong, obtuse, glabrous on both surfaces or sparsely ciliate outside on the portion exposed in bud, pale yellow (Foxworthy). Stamens 15 (15-20, Foxworthy) in pairs opposite the sepals, solitary opposite the petals; filaments flattened, less than half the length of the anthers; anthers oblong, broader at the base, posterior cells smaller than the anterior; appendage to connective mucronate. Ovary deeply embedded in the receptacle, surmounted by the rugose tomentose disc-like stylopodium; style columnar, sulcate, glabrous; slightly enlarged, obscurely 3-lobed (see Pl. II). Fruit: stalk 2-3 mm. long, verrucose, sub-glabrous; calyx tube enclosing and adnate to the nut, globose when mature, 1-1.5 cm. diam., minutely verrucose, glabrous; 2 large calyx lobes linear spathulate, usually about 10 cm. × 1.5 cm., but may be up to 14 cm. long; 3 small lobes linear acuminate, 1-2.5 cm. long; nut crowned by the enlarged tomentose disc-like stylopodium and persistent style. Embryo as in A. scaphula.

The earliest collection of this species is probably Alvins (Cantley's collector) 2160 from Merlimau in Malacca made in 1885, which is most likely the specimen Ridley had in mind when he recorded *Anisoptera glabra* as "mersawa"

merah" in 1901.

Other early collections are Holmberg 841 (1891) and Derry 1166 (1892), also from Malacca, and Ridley 6886 (Kew No. 210) collected in the Botanic Gardens Singapore in 1895. The first was examined by Brandis who, in 1895, made some pertinent notes on the specimen and suggested that it might be a new species.

In 1910 Ridley cited the four collections mentioned above, all of which were in fruit, under A. glabra, but in his Flora in 1922 he evidently realised that they represented

a distinct species, as Brandis had suggested, and described them under the name of A. laevis Ridl.

Foxworthy's early conception of this species is explained in my notes under A. scaphula. In Mal. For. Rec. 10 his conception is quite clear but C. F. 631, cited under A. laevis, is actually A. scaphula. Foxworthy (p. 102) remarks that it is difficult to distinguish this species from A. thurifera without flowering material. Personally I do not find it so. In fruit A. laevis is distinct by reason of its peculiar style and stylopodium while sterile specimens have smaller leaves with fewer nerves and are furnished with distinctive reddish scales on the under surface. I do, however, find sterile specimens of A. scaphula and A. thurifera almost indistinguishable in certain conditions.

Collections examined—

MALAY PENINSULA: PERAK: C. F. 0103, 7050, 10394, 11020, 25536, 25602, 25823, 28560, 29915, 30660, 32262 & 33789.

KELANTAN: C. F. 30720.

Pahang: C. F. 4635, 4996, 5058, 5487, 5504, 10587, 15621, 26104, 28214 (?) & 28247.

SELANGOR: C. F. 9645, 10939, 24025, 24033, 24064, 24455, 24704 & 27942.

NEGRI SEMBILAN: C. F. 0638, 0647 & 23755.

MALACCA: Holmberg 841; S'pore 2160 (Alvins); Derry 1166; C. F. 18276.

SINGAPORE: S'pore 6886 (Kew No. 210) Ridley (auth.

spec. of A. laevis Ridl.) & 2047.

Anisoptera laevis is our most common form of smooth-leaved mersawa. Notes are made on early collections of the species and a botanical description is given for comparison with the closely related A. scaphula, a less common mersawa found mainly in the north of the Peninsula.

Anisoptera costata Korth., Verh. Nat. Gesch. Ned. Overz., Bot. 67, tab. 6, fig. 1–9 (1839–'42); Ridl. in Agri. Bull. S. S. & F. M. S. 1: 60 (1901); in Journ. R. As. Soc. St. Br. 54: 25 (1910) partim, et Fl. Mal. Penins. 1: 218 (1922) partim; V. Sl. in Bull. Jard. Bot. Buitenz III, 8:7, fig. 1 (1926); Foxw. Mal. For. Rec. 3: 79 (1927) in obs., et Mal. For. Rec. 10: 97 (1932). Plate III A.

This species, described from Borneo by Korthals in 1839, was first collected in the Peninsula by Holmberg in Malacca in 1891. Ridley recorded this collection as A. costata in 1900 but in 1910 he included along with it his 6684 from the Gardens' Jungle, Singapore. This latter

collection is one of those upon which van Slooten founded

his A. megistocarpa.

This confusion of two species under the name of A. costata persisted in the Flora of the Malay Peninsula where the specimens cited from Batu Tiga (Holmberg) and Bangi (Mitchell, C. F. 1042) belong to A. costata and the remainder to A. megistocarpa. Van Slooten cleared up the confusion in 1926 when he described his A. megistocarpa but under A. costata cited only one collection (C. F. 1042) from the Malay Peninsula. Foxworthy (Mal. For. Rec. 10) also cites only the one collection, having also confused this species with A. megistocarpa. He records A. megistocarpa from Kuala Lumpur and Upper Perak on the evidence of collections (C. F. 13712 and 10409) which are actually A. costata.

It will be seen from the citation of specimens that A. costata is by no means as rare a tree in the Peninsula as

has been supposed.

Under A. oblonga I have made some notes concerning the relationship of A. costata to A. oblonga and other closely allied species.

Collections examined—

SIAM: C. F. 2993.

MALAY PENINSULA: PERAK: C. F. 10409, 30310 & 30903.

SELANGOR: C. F. 1042, 9992, 13712, 14840, 17073 & 32667.

MALACCA: Holmberg 768.

SUMATRA: F. R. I., E. No. 399 & 546, T. No. 330 & 896. JAVA: F. R. I., E. No. 1367.

BORNEO: Korthals, G. Sakæmbang (Auth. spec. of A.

costata Korth.).

Anisoptera costata is a form of mersawa with rather larger leaves, yellow and hairy on the undersurface. It is found on low-lying land and is here shown to be more common than has been supposed. Reference is made to the former confusion of this species with A. megistocarpa.

Anisoptera oblonga Dyer in Hook. f. Fl. Brit. Ind. 1: 301 (1874); Pierre, Fl. For. Cochinch. 15, t. 235 et 236 (1890) in obs.; Brandis in Journ. Linn. Soc. 31: 42 (1895); Guérin ex Lecomte, Fl. Gen. l'indo-chine 1: 369 (1912): Shorea nervosa Kurz, For. Fl. Brit. Burma 1: 119 (1877); Pierre, l.c. t. 235 in obs.; Brandis l.c.: ? Anisoptera cochinchinensis Lanessan, Pl. Utiles Col. Fr. 268 (1886); Pierre, l.c. t. 235 A et t. 253; Brandis, l.c.; Heim in Bot. Tidsskr. 25, 1: 44 (1902); Guérin, l.c. 367; Craib, Fl. Siam. Enum. 1: 139 (1925);

Lecomte, Bois d'indo-chine 115, fig. 15, 3, 4 & 5 (1926): ? Anisoptera glabra Pierre, l.c. t. 235 B, et Guérin, l.c. 368, non Kurz: ? Anisoptera robusta Pierre, l.c. t. 236; Brandis, l.c.; Guérin, l.c. 368; Craib, l.c. 140: ? Anisoptera marginatoides Heim in l.c.; Guérin, l.c. 369; Craib, l.c. 139. Plate III B.

Anisoptera oblonga was first collected by Griffith in Mergui and described by Dyer in 1872. In 1877 Kurz described his Shorea nervosa from a sterile collection from Tenasserim (not seen by me) which Pierre and Brandis

later identified as A. oblonga Dyer.

Up to the time of Foxworthy's "Dipterocarpaceæ of the Malay Peninsula" (Mal. For. Rec. 10 (1932)) no collection suggestive of this species had been made in the Peninsula, but in 1933–34 three flowering collections were made in Kedah and Kelantan which exactly match Burmese collections of A. oblonga.

Of the collections examined by me I consider the

following to be A. oblonga Dyer without doubt—

BURMA: Griffith 939 (Auth. spec. of A. oblonga Dyer);
Maymyo 7513 (Field No. 5047), 9378 (Field No. 8055)
& 9403 (Field No. 8058).

MALAY PENINSULA: KEDAH: C. F. 21663 & 30133.

KELANTAN: C. F. 29096 & 33284.

After studying carefully the above collections and collections of A. costata, and after making numerous floral dissections, I am struck with the very close affinity of these species. Indeed I can find no satisfactory character upon which they can be separated, other than the nature of the epidermal covering. All the collections of these species that I have examined have been furnished, on the undersides of the leaves and to some extent on the branchlets and panicles, with three forms of trichome—1, peltate scales; 2, dense tufted stellate hairs; and 3, long simple hairs or stellate hairs with a few long arms (all gradations are found between 2 and 3). In A. costata usually all three forms of trichome are plentiful but in A. oblonga "3" are almost absent and "2" are sparsely distributed.

This difference between A. oblonga and A. costata may be a local variation of a single species due to climate condition rather than a specific difference. However, it would not be wise to unite these species until more

collections are available for study.

I also consider that A. cochinchinensis Lanessan and A. robusta Pierre probably do not differ specifically from A. oblonga. Nor am I satisfied that A. glabra Pierre is distinct. From the evidence of Pierre's description and

figure it is clear that his A. glabra is not A. glabra Kurz [=A. scaphula (Roxb.) Pierre].

Pierre enumerates the diagnostic characters of A. cochinchinensis thus—"Spécifiquement, nous distinguons?" A. cochinchinensis de l' A. oblonga Dyer, par les feuilles munies d'un plus grand nombre de petites côtes; par des fieurs un peu plus grandes, contenant de 30 à 35 étamines au lieu de 25; par les nervures des ailes du calice fructifère, également élevées sur les deux faces. Ses feuilles sont un peu plus oblongues que celles de l' A. costata, et moins souvent cordées, plus glabres; ses anthères sont glabres, ainsi que les ailes de son calice fructifère, d'ailleurs moins larges et moins longues".

All the characters mentioned by Pierre are subject to considerable variation within the species in *Anisoptera*. Even the number of stamens I have found to vary within wide limits in some of the species and I have counted 30 stamens in the flowers of one Burmese collection of typical *A. oblonya*.

Pierre evidently felt that the evidence for specific separation of his A. cochinchinensis and A. glabra was slender because he adds—"On ne saurait dissimuler le grand rapprochement de ces trois espèces (A. cochinchinensis, A. oblonga and A. costata), et même de celle—ci et de la suivante (A. glabra Pierre), qui se fait remarquer surtout par son calice fructifère, dont les petites ailes sont plus étroites et plus longues."

Concerning A. robusta, Pierre savs—"C'est avec beaucoup d'hésitation que je distingue cette espèce des A. glabra, A. oblonga et A. costata, trois espèces ayant une étroite affinité. De la première surtout, il est très difficile de la séparer si l'on considère que le fruit est seul connu et qu'il est possible qu'elle soit l' A. oblonga. De toutes deux, elle diffère par ses feuilles velues et par l'extrémité arrondie de ses feuilles. De l' A. oblonga, elle se distingue encore par des fleurs plus grosses, des sépales plus longs et plus Dans la plante de Mergui, type de l' A. oblonga, les plus grands sépales n'ont que deux mm. de longueur et sont pubérulents. Les pétales y ont 4 mm. 1/2 de longueur et les nervures sont au nombre de 7. On y trouve 25 étamines. Les anthères glabres longues d'un mm, y sont terminées par un connectif long de 2 mm. 1/2. Le style y est ovoide J'avais pensé aussi, avant d'avoir vu la plante de Korthals, que c'etait l' A. costata, mais là les feuilles sont cordées acuminées, le nombre des petites côtes est de 20-24, les anthères sont pubescentes et le style linéaire-oblong.

De l' A. cochinchinensis on ne peut distinguer l' A. robusta que par les boutons plus allongés, par son inflorescence, ses feuilles velues et le nombre de ses étamines."

The only authentic specimen of A. robusta I have examined is Thorel 2696 which has flowers practically identical with those I have dissected on some of the sheets of A. costata. The predominance of the third form of trichome appears to be the only character that distinguishes A. robusta Pierre from A. costata Korth., A. oblonga Dyer, A. cochinchinensis Lanessan, and A. glabra Pierre (non Kurz) all of which may be proved to be conspecific when more complete material is available.

I have reason to suspect that *A. marginatoides* Heim which is represented by a single fruiting specimen from Chantaburi (not seen by me) may also have to be reduced to synonymy with the above. There is nothing in the

description of the species to preclude such reduction.

Under A. costata Korth. I have cited the collections examined that I consider typical of Korthal's species and under A. oblonga Dyer those that I consider typical of Dyer's form. The following collections probably do not differ specifically from the above but as they are hardly typical of either it seems desirable to keep them separate meanwhile—

CAMBODIA: Foxworthy Nos. 4, 5 & 12.

COCHIN CHINA: Pierre 1550 (auth. spec. of A. cochinchinensis Pierre), Thorel 2696 (A. robusta Pierre).

BURMA: Calcutta 964 & 8062; Bot. Survey Tenas. Circ. 328 (Maymyo 605 N/972).

SIAM: For. Dept. Siam No. 871; S'pore 2708.

MALAY PENINSULA: KELANTAN: C. F. 29122, 29082, 29969, 32725 & 33408.

Pahang: 5151, 28323 & 29969.

Anisoptera oblonga is a form of mersawa occurring in Burma. It has recently been collected in Kedah and Kelantan. It is suggested that this tree may not differ specifically from A. costata and certain other forms described from Cochin China and Siam, but more collections are required to decide the point.

Anisoptera marginata Korth. Verh. Nat. Gesch. Ned. Overz. Bez., Bot. 66, t. 6, fig. la-13a (1839-'42); Ridl., Fl. Mal. Penins. 1: 219 (1922); V. Sl. in Bull. Jard. Bot. Buitenz. III, 8: 5 (1926); Foxw., Mal. For. Rec. 10: 96 (1932): ? Anisoptera grandiflora Brandis in Journ. Linn. Soc. 31: 43, pl. 2, fig. 29 (1895); V. Sl., l.c. 10, in nota. Plate III C.

Van Slooten has given an excellent description of this species which is reproduced by Foxworthy in Mal. For. Rec. 10. In the flowers examined by me I find that the number of stamens varies from 25-28 and that occasionally there are 4 styles. Four styles have also been noticed in A. oblonga. Occasionally on dissection there appear to be more than 4 styles. This is due to the fact that each style is readily divisible into two, a condition found in all the species of Anisoptera I have examined (sect. Glabrae excepted).

A. marginata was originally described by Korthals from Borneo and was first recorded from the Malay Peninsula by Ridley in 1922 on the evidence of a single collection (C. F. 3601) from Kuantan. In 1926 van Slooten cited only this collection and in 1932 Foxworthy added only one other from Ulu Rompin. It is now possible to add considerably to the citation of collections from the Malay Peninsula. It appears that this species is not uncommon in our swamp or semi-swamp forests near the coast.

Van Slooten has suggested that A. grandiflora Brandis may prove to be a synonym of A. costata Korth. I am of opinion that it is only a large-leaved collection of A. marginata. This is, however, difficult to prove because these two species are essentially similar in flower structure, the best diagnostic character being the more numerous veined and more pubescent leaves of A. costata.

Collections examined--

MALAY PENINSULA: PERAK: C. F. 27804, 27806 & 30753.

SELANGOR: C. F. 23927, 23948, 24562, 27070, 29717,

29718, 29730, 29738, 30771 & 36029.

Pahang: C. F. 3601 & 15496. Singapore: C. F. 30759.

SUMATRA: F. R. I. Nos. 382, 385, 398 & 403; F. R. I. No. b.b. 5788.

BANGKA: Teysmann sine no.

JAVA: Cult. in Hort. Bog, IX-D-171.

BORNEO: ? Haviland (Garai) 959 [auth. spec. of A. grandiflora Brandis]; Garai sine no. 26.2.92 (fruit—possibly from same tree as 959); F. R. I. No. b.b. 14895 & E. No. 5056.

Anisoptera marginata is a form of mersawa found usually in semi-swamp jungle such as Utan Melintang or Telok. It was recently discovered in Sungei Buloh Reserve.

Anisoptera megistocarpa V. Sl. in Bull. Jard. Bot. Buitenz. III, 8: 12, fig. 2 (1926); Foxw., Mal. For. Rec. 10: 98 (1932): Anisoptera costata Ridl. in Journ. R. As.

Soc. Str. Br. 54: 25 (1910) partim, et Fl. Mal. Penins. 1: 218 (1922) partim; Burkill, Journ. Str. Br. R. As. Soc. 75: 43 (1917); non Korth. Plate IV A.

Van Slooten and Foxworthy have given very complete descriptions of this species and van Slooten has published a very good figure of the branchlet, inflorescence and fruit. I should like to add the following notes—In examining the flowers of Ridl. 6684, Burkill 526, and C. F. 624 I find the number of stamens to vary between 47 and 54 (30-32 in published descriptions) and that the arrangement of the styles is essentially as in A. costata etc., i.e., there are three closely appressed styles with minute stigmas. On dissection each style is found to be notched at the apex and easily divisible into two (vide my notes under A. marginata).

This species was collected by Ridley in the Botanic Gardens Jungle, Singapore as early as 1894. In 1910 and again in 1922 Ridley recorded these collections along with authentic material of *A. costata* under the latter name. It was not until van Slooten described his *A. megistocarpa* in 1926 that the Peninsula collections of these two species were separated, but recently confusion has again occurred (vide my notes on *A. costata*).

We have at Kepong three sterile collections (C. F. 28702, 30561 and 30610) from Brunei which look like small-leaved specimens of A. megistocarpa. It is probable, however, that they represent an undescribed species (vide also my notes on A. Curtisii).

Collections examined—

MALAY PENINSULA: PERAK: C. F. 27337, 27821 & 31083.

Pahang: C. F. 29951.

NEGRI SEMBILAN: C. F. 427, 624 & 669.

MALACCA: C. F. 2091 & 9296.

SINGAPORE: Ridley 6684 (cited as 6634 by V. Sl.) (fl. and ft.—auth. spec. of *A. megistocarpa* V. Sl.); S'pore Gdns. No. 526; S'pore sine no. (Burkill 1916) & sine no. (Md. Nur 1924).

Anisoptera megistocarpa is a form of mersawa with a conspicuous dark crown due to the hairy red-brown undersurfaces of its leaves. It may be seen in Bikam, Pasir Panjang (N. S.), and the Malacca among other reserves, but is not plentiful.

Anisoptera Curtisii Dyer ex King in Journ. As. Soc. Bengal 62, pt. 2: 100 (1893); Brandis et Gilg in Engler, Nat. Pflanzenfam. III, 6: 263, t. 122, fig. F. (1894) and 2nd edit. 21: 259, t. 112 fig. F. (1925); Brandis in Journ. Linn. Soc. 31: 42 (1895); Burkill, Journ. Str.

Br. R. As. Soc. 81: 51 & 63 (1920); Merr., Bibl. Enum. Born. Pl. 400 (1921); Ridl. Fl. Mal. Penins. 1: 218 (1922); V. Sl. in Bull. Jard. Bot. Buitenz. III, 8: 11 (1926); Foxw., Mal. For. Rec. 3: 79 (1927) in nota, et Mal. For. Rec. 10: 99 (1932); non Foxw. in Philip. Journ. Sc. Bot. 6: 255, t. 41 (1911), l.c. 13: 181 (1918), et ex Merr., Enum. Phil. Fl. Pl. 3: 92 (1923): Anisoptera Curtisii var. latifolia King, l.c. Plate IV B.

The only description of this species based on both flowering and fruiting material is that of Foxworthy in Mal. For. Rec. 10. The following is an amplified description

based upon my own experience of our collections.

Branchlets rugulose, slightly flattened, densely clothed with a scabrous, ferruginous, fugacious, stellate tomentum, Leaves oblong or elliptic-oblong to obovate, usually rather abruptly tapering at both ends, apex acute or shortly acuminate, base rounded, obtuse to slightly cordate (rarely acute), usually about 10 cm. \times 4 cm. but may be much smaller or up to 14 cm. × 7 cm. (var. latifolia King), glabrous, shining red-brown above when dry, beneath, when young, usually sparsely pubescent and pale vellow, later glabrescent and densely ochraceous lepidote; midrib deeply depressed above, somewhat purple beneath; secondary nerves 18-20 prs. conspicuously looped towards the margins, with occasional short intermediary veins, sometimes slightly depressed above, conspicuously raised and purplish beneath: reticulations visible on both surfaces; petioles enlarged in the upper portion, 1-2.5 cm., rugulose, scabrous, squamate: stipules linear oblong, sub-falcate, acute, 7 × 2 mm., scabrous, caducous. Panicles lax, pendulous, racemose, up to 15 cm. long, rugose, scabrid; ultimate branchlets distant, up to 4 cm. long, each bearing 3-10 distichous flowers 2.5-5.0 mm. apart. Flowers acuminate in bud, 11.0 mm. including the pedicel; pedicel 3 mm., scabrid tomentose. slightly imbricate in bud, sub-equal in length, 2 ovate oblong obtuse, 3 ovate acuminate, all stellate tomentose outside, pubescent inside. Petals in bud slightly contorted, involute and reflexed at apex, lanceolate acuminate, glabrous except along one margin outside, "greenish white" (Haniff, S'pore 3692). Stamens 24-26 (usually 25) in two whorls; filaments longer than the anthers, slightly flattened, broader towards the base; anthers oblong, posterior cells much smaller than the anterior; appendage to connective filiform, more than 3 times as long as the anther. Ovary 2/3 inferior, tomentose, surmounted by a sub-globose, subsulcate, tomentose stylopodium; styles 3 (occasionally 4).

short, glabrous, closely appressed in young flowers, each notched at apex and easily divisible into 2; stigmas minute. Fruit: stalk 4 mm. long, puberulous; calyx tube companulate, adnate to 2/3 of the nut, about 1.2 cm. diam. and 1 cm. high, lævigate or sub-verrucose puberulous; 2 large calyx lobes linear-spathulate, usually about 9 cm. \times 1.2 cm. but may be up to 12 cm. \times 2 cm., minutely puberulous or glabrate; 3 small lobes linear acuminate, up to 1.5 cm., puberulous or glabrate; nut 2/3 enclosed in the calyx cup, globular, about 1 cm. diam., glabrate or puberulous, surmounted by the conical stylopodium and remnants of the styles (stamens frequently persist for a long time but have fallen before the fruit reaches maturity).

The earliest collections of this species were made in the Larut hills by Kunstler in 1882 and in Penang by Curtis in 1885–92. Upon these collections King founded his species in 1893 using Dyer's manuscript name. One of Curtis's collections has broader leaves than the others, which fact induced King to form for it the variety latifolia. Subsequent authors, however, are agreed that varietal

separation is not justified.

Although it would be surprising to find A. Curtisii, which is so widely distributed on hills in the Malay Peninsula, strictly confined to this portion of the Malayan region, a wider distribution seems hardly sufficiently proven. The collection on the evidence of which Foxworthy (Mal. For. Rec. 10) records the species from Peninsular Siam, and Burmese collections under the name of A. Curtisii in the herbariums of Maymyo and Calcutta, are, I consider,

related to A. oblonga (see citations on p. 13).

From Sumatra van Slooten records the species on the evidence of three sterile collections which I have not seen. From Borneo Brandis recorded a collection by Burbidge, and van Slooten added several other collections from that island. Of these I have examined Haviland, sine no. (July 1905, Brunei) and bb. 8156 (ex herb. Bog.) and am of opinion that they represent an undescribed species with the facies of a small-leaved form of A. megistocarpa. Recent sterile collections from Brunei (C. F. 28702, 30561 and 30610) are from the same species.

Foxworthy has recorded A. Curtisii from the Philippines but I am in agreement with van Slooten who questions his identification. I have examined Bur. Sci. Phil. 8985 cited by Foxworthy under A. Curtisii and I am of opinion that they are more correctly referable to A. brunnea Foxw. a

species closely related to A. thurifera (Blco.) Bl.

Although superficially A. Curtisii is, as van Slooten and Foxworthy have remarked, probably most liable to be

confused with A. costata and A. marginata, its natural affinity, I venture to suggest, is rather with A. thurifera Bl. thurifera has almost twice as many stamens but the stylopodium and styles, as well as the other flower parts. are very alike; this may be seen by comparison of floral dissections given on plate IV B & C.

Collections examined-

MALAY PENINSULA: PENANG: Curtis 4428 (3 coll.) & sine no. Govt. Hill, 1893, fl. & ft. (Auth. specs. of A. Curtisii Dyer); Curtis 1400 (auth. spec. of A. Curtisii var. latifolia King); Fox 78 & 85; Haniff, sine no. (1918); S'pore 1521, 3281, 3481, 3692, 3723, 3762 & 4566; C. F. 10845, 11662, 27781 & 28017.

PERAK: Kunstler 3618 & 3706; C. F. 16585, 24635, 25475, 25488, 25546, 25601, 28559, 28563 & 32180.

DINDINGS: C. F. 16591 & 27848. KELANTAN: C. F. 32717 & 33409.

TRENGGANU: C. F. 26747, 26752 & 26761. SELANGOR: C. F. 16009, 22942, 23657, 24029 & 27136. NEGRI SEMBILAN: C. F. 742, 1192, 2103 & 18884.

SINE LOC.: C. F. 11713.

Anisoptera Curtisii is a form of mersawa with small bright yellow leaves found upon hills particularly in the northern portion of the Peninsula. It is very plentiful on Penang Island where it was first collected and is apparently known as rengkong. The plant is described and its probable distribution outside the Malay Peninsula is discussed.

Hopea sangal Korth. in Verh. Nat. Gesch. Bot. 75 (1839-'42); Blume, Mus. Bot. Lugd. Bat. 2: 34 (1852); Miq. Fl. Ind. Bat. 1, pt. 2: 504 (1859); A.DC. in DC. Prod. 16, pt. 2: 635 (1868); V. Sl. ex Heyne, Nutt. Plant. Ned. Ind. 2nd edit.: 1111 (1927): Petalandra micrantha Hassk., Hort. Bog. Descr. 105 (1858); Mig., l.c. 505; A. DC. in l.c.; King in Journ. Asiat. Soc. Bengal 62, pt. 2: 126 (1893), in nota sub H. micrantha Hook. f.: Hopea fagifolia Miq., Fl. Ind. Bat. Suppl. 490 (1860); Scheff. in Nat. Tijdschr. Ned. Ind. 31: 351 (1870); Brandis in Journ. Linn. Soc. 31: 65 (1895); Berl., Cat. Hort. Bog. 1 & 2: 103 (1899); Koord. & Val., Boomsoort. Java 5: 124 (1900); Sym. in Gdns. Bull. S. S., 7, pt. 2: 151 & 154 (1933) in nota: *Hopea* diversifolia Scheff., l.c., Burck in Ann. Jard. Bot. Buitenz. 6: 239 (1887), et Brandis in l.c. 64, non Miq., l.c. 491; Foxw. Mal. For. Rec. 10: 123 (1932) in obs.: Hopea odorata Auct. (1876-1927), partim, quoad syn. H. sangal: Doona odorata Burck in l.c. 233 quoad syn. H. sangal: Doona micrantha Burck in l.c. 234: Doona

javanica Burck in l.c. 235, t. 29, fig. 7: Hopea micrantha Benth. et. Hook. f. ex Heim, Rech. Diptéroc. 64 (1892) in obs.: Hopea Hasskarliana Heim, l.c.: Hopea javanica Heim l.c.; Brandis in l.c. 65: Hopea Curtisii King in l.c. 124 et in Ann. Bot. Gard. Calcutta 5: 155, pl. 187B (1896); Brandis in l.c. 65; Burkill, Journ. Str. Br. R. As. Soc. 81: 66 (1920) fig. 113-120; Ridl., Fl. Mal. Penins. 1: 236, fig. 22a (p. 212) (1922); Foxw., l.c. 130: Hopea globosa Brandis in l.c. 61; Ridl. in Journ. Str. Br. R. As. Soc. 54: 26 (1910) et Fl. Mal. Penins. 1: 236 (1922); Foxw., l.c. 121: Hopea Lowii Dyer ex Brandis in l.c. 63; Ridl. in Journ. Str. Br. R. As. Soc. 73: 143 (1916) et Fl. Mal. Penins. 1: 237 (1922); Foxw., l.c. 123: Doona micrantha var. macrosepala Bærl., MSS. in Herb. Bog. (1900): Hopea fagifolia var. fol. latioribus Bærl. MSS. in Herb. Bog. (1900); Hopea fagifolia var. javanica Berl., MSS. in Herb. Bog. (1900): Hopea macrosepala Bærl., MSS. in Herb. Bog. (1900): Hopea multiflora Foxw., l.c. 119, partim, non Brandis: Hopea albescens Foxw., l.c. 122, non Ridl. Plate V.

The most complete description of this species is given by Foxworthy under *Hopea Curtisii* but as that was based upon a limited number of specimens it seems desirable to recast the description to cover all the collections here

considered to be \tilde{H} . sangal.

Branchlets dark purple when dry, lenticellate, pale fugacious tomentose towards the ends. Leaves usually ovate lanceolate but very variable from lanceolate to broadly ovate. apex acuminate, base slightly unequal rounded to cuneate. usually about 10 cm. × 4.5 cm. but varying between wide limits, grey-green or tawny coloured and shining above. usually darker beneath and glabrous or sparsely stellate puberulous upon the nerves; midrib slightly depressed above. glabrous, strongly elevate and tomentose to puberulous beneath; secondary nerves 10-14 pairs, strongly elevate on the lower surface, commonly with barbate domatia in the axes of the lower pairs; tertiary nerves rather obscure, joining the secondaries in numerous more or less parallel lines; petioles usually puberulous and rugose, about 1 cm.; stipules linear, about 3 mm. long, falling very Panicles axillary and terminal, pendulous, racemose, when axillary shorter than the leaves, grey or tawny tomentose; ultimate branches about .5 cm. apart, up to 2.2 cm. long, each bearing 6-15 closely set secund flowers. Flowers oval in bud, 3 mm. long including the pedicel; pedicel about 1 mm., tomentose. Sepals imbricate; two ovate or oblong, thick, tomentose outside and on the upper half

inside; three smaller, more or less rotundate and irregular. tomentose outside only.* Petals contorted in bud, oblong. fimbriate at the apex, tomentose outside on the portion exposed in bud, white. Stamens 10, two appressed to each petal; anthers oblong, the posterior cells almost as large as the anterior; filaments a little longer than the anthers with broad flattened overlapping bases; appendage to connective filiform, about the same length as the anther. broadly cylindrical truncate, puberulous on the upper portion which may be considered to be the stylopodium. glabrous on the lower; style less than half as long as the ovary, glabrous; stigma minute. Fruit: stalk 1 mm. long, tomentose; calvx lobes united to form a flat open tomentose receptacle; 2 large calyx lobes spathulate, usually about 7 cm. \times 1.7 cm., 8-10 nerved, puberulous towards the base; 3 small lobes oblong obtuse or orbicular, striate, puberulous, about half as high as the mature nut; nut globose, apiculate, about 1 cm. diam., sparsely tomentose. (When immature the nut is conical and almost enveloped by the small calyx lobes). Embryo: cotyledons erect, unequal, longitudinally striated: dorsal cot. slightly embracing the placental cot. and alone reaching the apex of the ovary; placental cot. smaller; radicle erect, exposed on one side between the lobes of the dorsal cotyledon.

Hopea sangal was first collected by Korthals in about 1840 from Borneo. He gave an excellent description of the field characters of the tree sangal, but, being based on limited sterile material, it was hardly adequate from a botanical point of view and led to misinterpretation and confusion by Hance and others with Roxburgh's Hopea edorata (1832) from India, to which species H. sangal was reduced by Hance in 1876. This reduction appears to have been accepted by all authors, Kurz excepted, for over half a century, and on the strength of it H. odorata has been erroneously recorded from Borneo, until in 1927 van Slooten indicated that separation was necessary. that period or earlier Korthals' plant had been recollected on numerous occasions, referred to various species, and described under a variety of names.

In 1856 Hasskarl founded his new genus *Petalandra* and described his *P. micrantha* from collections from east Java. When Bentham and Hooker [Gen. Plant. I (1862–67) 193] united *Petalandra* Hassk. with *Hopea* Roxb., confusion arose between this species and *Hopea micrantha* Hook. f., (1862) a quite distinct plant. Reference is made to the

^{*} On some collections the receptacles and calyx parts show a tendency to enlarge even before the buds have opened. This is the condition of the flower figured in Plate V, 6a, 8a and 9a.

problem by Hance in Journ. Bot. 5: 308 (1876), by King in Journ. As. Soc. Bengal 62, pt. 2: 126 (1893), and by Heim in Rech. Diptéroc. 64 (1892) who proposed the epithet *Hasskarliana* for Hasskarl's plant, that of Hooker having prior claim to the trivial *micrantha*.

In 1860 Miquel redescribed *H. sangal* from a sterile collection of Teysmann from Bangka as "*Hopea? fagifolia*" and in 1870 Scheffer referred another collection of Teysmann ("prope Djebæs") to Miquel's species without having seen the type. I have not seen the Djebæs collection and I am in doubt as to whether it was correctly placed by Scheffer.

Scheffer also referred collections of Teysmann from Sumatra to *Hopea diversifolia* Miq. In this he was wrong. *H. diversifolia* Miq. is founded on two collections which I have examined and find to represent two distinct species

neither of which is H. sangal.

In 1877, when Burck transferred Petalandra Hassk. and several species of Hopea to Doona, he created the combinations Doona odorata (under which he retained H. sangal) and Doona micrantha, and reduced H. fagifolia Miq. to the latter species. At the same time he described H. sangal yet again from Javanese collections, under the name of Doona javanica, a name that was altered by Heim in 1892 to Hopea javanica with the transfer of Burck's Malayan species of Doona to Hopea. In 1899 Bærlage, and in 1900 Koorders and Valeton, suggested the union of H. javanica with H. fagifolia Miq. and Hopea (Petalandra) micrantha.

The earliest recorded collections of *H. sangal* from the Malay Peninsula were made by Kunstler in Perak (1885) and Curtis in Penang (1888). Upon these collections King

founded his Hopea Curtisii in 1893.

Another Peninsula collection from Perak was made by Wray jnr. and described by Brandis in 1895 as *Hopea globosa*. At the same time he described two collections, one by Lowe in Borneo and the other by Teysmann in Sumatra, as *Hopea Lowii* using a name given in manuscript by Dyer.

In the Flora of the Malay Peninsula (1922) Ridley referred some additional collections to *H. Curtisii* and *H. globosa* and recorded *H. Lowii* from the Peninsula referring several collections to that species. He mentions,

however, that the last two are suspiciously alike.

Foxworthy, in Mal. For. Rec. 10 (1932), referred most of our broad-leaved collections of *H. sangal* to *H. Curtisii*; to *H. globosa* he referred one collection (C. F. 8023), and to *H. Lowii* one collection (Ridley 6585—formerly referred by Ridley to *H. globosa*). As *Hopea multiflora* Foxworthy

described a species closely related to *H. odorata* Roxb. that I am renaming *Hopea semicuneata*, but C. F. 5906 upon which he based the fruit description is *H. sangal*, as also are a number of collections cited under this heading with doubt. The remainder of our collections were cited by Foxworthy under *Hopea albescens*. *H. albescens* Ridl. is, however, a very distinct plant which I have reduced to *Shorea hopeifolia* (Heim) Sym. and discussed in Gdns. Bull. S. S. 7: 150 (1933).

Two reasons mainly account for the fact that H. sangal has been redescribed on so many occasions. The first is the inadequacy of the material upon which early descriptions were based and the second the variation in leaf within the The collections upon which King based his H. Curtisii and to which Berlage gave the manuscript names Doona micrantha var. macrosepala, Hopea macrosepala, and Hopea fagifolia var. fol. latioribus are typical of the broadleaved form represented by a number of our collections, most of which were placed by Foxworthy under the first name. Bærlage's manuscript species H. fagifolia var. javanica and our collections placed by Foxworthy under H. albescens are the ovate-lanceolate-leaved representative of Miguel's H. fagifolia and Brandis's H. globosa were described from collections of immature leaves probably taken from saplings (the fruits of Wray 816 are not All intermediate stages are attached to the leaves). represented in the collections I have examined and I am unable to recognise any clearly defined divisions within the species although I do not doubt that definable local strains do exist.

Some remarks seem necessary concerning the affinities of H. sangal. Petalandra micrantha Hassk., which is here shown to be a synonym of H. sangal Korth., was the species which Hasskarl founded the genus Petalandra. Bentham and Hooker and later authors have maintained Petalandra as a section of Hopea referring to it those species that differed from the section Euhopea in having, inter alia, 10 as opposed to 15 stamens. This is a convenient division but I am of opinion that the maintenance of Petalandra even as a section tends to obscure natural relationships. I should like to have the support of more detailed study of the anatomy and embryo development before making a final statement, but it seems to me unfortunate that H. sangal Korth. and H. acuminata Merr. should be separated from such species as H. odorata Roxb., H. Helferi Brandis (=H. dealbata Hance), H. nutans Ridl. and H. semicuneata Sym. because of a single character—the number of stamens. I have found on several occasions that in dipterocarps that normally have 15 stamens, one row may abort, or in those that normally have 10, 15 may be present. It would appear therefore that this character should be treated with reserve when considering natural relationships within this family.

Collections examined—

SIAM: C. F. 3761, 3835, 3863 & 3874.

MALAY PENINSULA: KEDAH: C. F. 12220, 17614, 17858,

27061, 27464 & 27472.

PENANG: Curtis 1562 (Auth. spec. of *Hopea Curtisii* King); S'pore 3459, 3473 (H. B. 933.21.5), 3504 (H. B. 933.21.4), 3655, 3715 & 3717; C. F. 28005 (Hort. Penang Tree No. 18) & 28010 (Hort. Penang Tree No. 15).

PERAK: King 8161 (Auth. spec. of *Hopea Curtisii* King); Wray 816 (Auth. spec. of *Hopea globosa* Brandis) & sine no. (Larut); Harun sine no. (1906); C. F. 0118, 8023, 11022, 11590, 13233, 30816, 30913, 31403 & 32261.

KELANTAN: S'pore 24839, C. F. 32733 & 32834.

TRENGGANU: C. F. 26961.

Pahang: C. F. 1262, 1281, 2754, 4650, 4855, 5160, 5469, 5480 (H. B. 933.21.2 & 7), 6697, 8139, 8887, 10564, 10659, 15147, 15500, 15629, 15714, 15765, 17286, 18653, 18667, 26182, 26501 & 27995.

SELANGOR: Ridley, sine no. (Rantau Panjang); Mat, sine no. (1908); C. F. 8372, 14586, 24906 & 32871. NEGRI SEMBILAN: Clerk sine no. (1912); C. F. 619, 659, 1886, 1991, 4206 & 20106.

JOHORE: Curtis 3613; C. F. 5906, 5984 & 12058.

SINGAPORE: Ridley 6585.

SUMATRA: Teysmann 12039 (H. B. 933.21.61), 12040 (H. B. 933.21.59) & 12042 (H. B. 933.21.60) [Auth. specs. of *H. diversifolia* Scheff], & sine no. in Herb. Kew. [Auth. spec. of *H. Lowii* Dyer]; Grashoff 217 (H. B. 933.21.10), 715 (H. B. 933.21.9) & 973 (H. B. 933.21.52); Remoorin sine no. (H. B. 933.21.51); F. R. I. bb. 16395 (H. B. 933.21.68); H. B. 933.21.8.

BANGKA: Teysmann 3236 (H. B. 933.21.16) [Auth. spec. of *H. fagifolia* Miq.]; 1520 (H. B. 933.21.15).

JAVA: Teysmann 12043 (H. B. 933.21.37) [Auth. spec. of $P.\ micrantha$ Hassk.]; Burck sine no. (H. B. 933.19.2; H. A. R. T. 72511) [Auth. spec. of $D.\ javanica$ Burck]; Koorders 1387 β (H. B. 933.21.48), 1556 β (H. B. 933.21.40), 1647 β (H. B. 933.21.47), 10004 β (H. B. 933.21.50), 20256 β (H. B. 933.21.46), 20326 β (H. B. 933.21.41), 23013 β (H. B. 933.21.39) & 24792 β (H. B.

933.21.49); Uhl 5951 (H. B. 933.21.14 & 44), & 5951a (H. B. 933.21.13 & 45); Van Steenis 2419 (H. B. 933.21.43); Kalshoven 33 (H. B. 933.21.36); Cult. in Hort. Tiekeumeuk—H. B. 933.21.24 (3-B-6); 933.21.56 (4-C-4) & 57 (4-D-4) [H. fagifolia var. fol. latioribus Bœrl.]; 933.19.1 (5-D-5) [H. macrosepala Bœrl. & D. micrantha var. macrosepala Bœrl.]; 933.21.54 (6-A-6) & 55 (6-D-4) [H. fagifolia var. javanica Bœrl.]; 933.21.22 & 23; Cult. in Hort. Bog.—H. B. 933.21.18 & 27 (VI-C-222); 933.21.19 (VI-C-222a); 933.21.20 & 28 (VII-B-22a); 933.21.25 (VII-B-65); 933.21.21 & 26 (VII-2-26a); 933.21.29, 30, 31, 32, 33, 34 & 35.

BORNEO: Korthals sine no. (H. B. 933.19.3; H. A. R. T. 72513) [Auth. spec. of *H. sangal* Korth.]; Lowe sine no. in Herb. Kew [Auth. spec. of *H. Lowii* Dyer]; Teysmann 8020 (H. B. 933.21.12); Hallier 1028 (H. B. 933.21.42); Dumont sine no. (H. B. 933.21.11); H. B. 1904 (933.21.17); For. Dept. B. N. B. No. 1234.

LOCALITY UNCERTAIN: H. B. 933.21.33 & 53.

Hopea sangal is quite common in the Peninsula, particularly in the north and in Pahang. It is usually found at low elevations near streams and has a dark, closely fissured bark upon which tears of white opaque damar are common. The most commonly applied vernacular names are damar mata kuching, chengal pasir and mesiput (Pahang). Collections of this tree from the Malay Peninsula and Islands have formed the types of a number of species which are shown to be synonymous and are united under the oldest name, Hopea sangal.

Hopea semicuneata Symington, sp. nov.: Hopea? diversifolia Miq., Fl. Ind. Bat. Suppl. 491 (1860) partim: Hopea sp., V. Sl. ex Merr., Univ. Calif. Pub. Bot. 15: 202 (1929); sama rupa chengal, Foxw., Mal. For. Rec. 3: 71 (1927): Hopea multiflora Foxw. Mal. For. Rec. 10: 119 (1932) partim, non Brandis: Hopea? plagata Sym. in Gdns. Bull. S. S. 7 pt. 2: 154 in obs., non Vidal. Plate VI.

Hopea odorata Roxb. affinis, petiolis brevioribus, ovario glabro, stylopodio truncato, stylo breviore differt; H. sangal Korth. similis, nerviis secondariis foliorum paucioribus, ovario glabro, staminibus 15 pro 10 distinguitur.

Branchlets terete, almost black when dry, puberulous towards the ends. Leaves* usually oblong lanceolate or ovate lanceolate, apex acuminate, base usually markedly

^{*} The very marked similarity between the leaves of this species and those of *H. plagata* Vidal led me to suggest the possible identity of those species (Symington, l.c.).

unequal, acute or cuneate on one side, obtuse or sub-acute on the other, about 11 cm. imes 4.5 cm. but variable, glabrous and usually drying grey-green above, glabrous or sparsely puberulous upon the veins and with a brown tinge beneath: midrib elevate on both surfaces; secondary nerves 8-10 pairs, inconspicuous above, elevate and frequently with barbate domatia in the axes of the lower pairs beneath; tertiary nerves hardly visible on either surface, joining the secondaries in numerous fine more or less parallel lines; petioles rugose, about 1 cm., puberulous, black; stipules (not seen). Panicles axillary and terminal. pendulous, racemose, about half as long as the leaves, grey or tawny tomentose; ultimate branches about 4 mm. apart, up to 1.6 cm. long, each bearing 3-9 closely set secund Flowers elliptical or ovate in bud, 3.5 mm. long including the pedicel; pedicel 1 mm., tomentose. imbricate, sub-equal in height; two oval or ovate, thick, tomentose outside and on the upper portion inside; three slightly broader, irregularly oval or rotundate, thinner, tomentose outside only. Petals contorted in bud, oblong, fimbriate at the apex, tomentose outside on the portion exposed in bud, pale yellow (M. Haniff, S'p. 3729). Stamens 15, in pairs opposite the sepals, solitary opposite the petals, of 3 heights; anthers oval, the posterior cells smaller than the anterior; filaments 2-3 times as long as the anthers. filamentous above, suddenly widening to the broad flattened basal portion; appendage to connective filiform, about twice the length of the anther. Ovary broadly cylindrical, slightly constricted before the upper third which may be considered as a stylopodium, flattened at the top where there is a papillose ring, glabrous; style short, cylindrical, glabrous; stigma minute. Fruit (immature—C. F. 24644); stalk 1 mm., puberulous; calyx lobes shortly united to form a flat puberulous disc-like receptacle; 2 large calyx lobes oblong spathulate to broadly elliptical, apex rounded, constricted and puberulous at the base, about 3.5 cm. long and 1-1.8 cm. broad, with 10-12 longitudinal nerves: 3 small lobes deltoid, obtuse, 2.5 mm. \times 2.0 mm., puberulous; nut globose, 5 mm. diam., puberulous.

I have given as allies to this species two species, H. odorata and H. sangal, conventionally considered to belong to different sections of the genus. My reasons for this will be evident from my notes on the affinities of H. sangal. H. semicuneata is a most interesting species because it supports the argument in favour of the union of the sections Euhopea and Petalandra by combining characters typical of each. It has the truncate stylopodium of Petalandra and the 15 stamens of Euhopea.

Collections examined—

MALAY PENINSULA: PENANG: S'p. 3729.

PERAK: C. F. 24644 (Type of young fruit) 25151, 25419, 28589 & 28595.

DINDINGS: C. F. 27838.

Pahang: C. F. 2729, 4526 (Type of flower), 5440, 6696, 7943, 7947, 24821, 26001, 26002, 26003, 26038, 29554 & 29555.

NEGRI SEMBILAN: C. F. 4403 & 26605.

Malacca: C. F. 18267 & 18268. BORNEO: B. N. B.: Elmer 21382.

Hopea semicuneata is the botanical name here given to the tree known in Kinta district, Perak, as sama rupa chengal. From parts of Pahang the names chengal, chengal batu, penak and penak batu have been recorded. The species was described as H. multiflora in Mal. For. Rec. 10, where, (p. 120) additional information concerning the field characters may be found. Usually this tree is found upon ridges up to about 1,200' but I have also found it on the peculiar association on sand, at sea level, at Pasir Panjang in the Dindings. The only Bornean collection known records the tree "in forests along tidal streams."

Balanocarpus Bedd.

The genus Balanocarpus was established by Beddome in 1873 upon two species (B. erosa and B. utilis) from the Tinevelly mountains in southern Madras, that differed from Hopea in having a woody nut enclosed in a 5-lobed woody cup. I have not examined any specimen of B. erosa but, if the specimens of B. utilis kindly lent to me by Mr. Parkinson, may be taken as representative of Beddome's Balanocarpus, it may reasonably be doubted whether the creation of a new genus was justified. In my opinion the importance of the nature of the fruiting calyx has been greatly overstressed by systematic workers on the Dipterocarpaceae. Thus it is that the genus Balanocarpus, originally created for two wing—less species related to Hopea odorata Roxb., has become the repository for dipterocarps of very diverse groups that have failed to conform to conventional generic definition by possessing, when in fruit, an accrescent calvx cup none of the lobes of which have developed into wings.

In 1899, Trimen added to the genus B. zeylanicus which is possibly most closely related to Hopea ferrea Lanessan.

In 1893 King added several others from the Malay Peninsula. B. Curtisii King is clearly related to Hopea myrtifolia Miq. and H. bracteata Burck [=B. bracteatus

(Burck) Merr.*]. B. penangianus King [=B. multiflorus (Burck) Sym.] is, as I have stated elsewhere Bull. S. S. 7, pt. 2: 129 & 152), very evidently related to a group of Shorea including S. Faguetiana Heim and S. hopeifolia (Heim) Sym. This relationship was observed by Heim (Recherch, Diptéroc.: 50) when he founded his genus Richetia upon R. coriacea Heim (=Balanocarpus coriaceus Auct.) and three other species now all reduced to B. multiflorus (Burck) Sym. Balanocarpus anomalus King was evidently placed in this genus at a venture in the absence of fruiting material and has since been reduced by Foxworthy to Hopea ferrea Lanessan. Balanocarpus maximus King is quite distinct from any of the other species hitherto referred to that genus. Its most close ally appears to be Balanocarpus longiflorus (Brandis) Foxw., both of which species appear to be more closely allied to some species in the Brachuptera section of Shorea than any others. Balanocarpus Heimii King is an anomalous species unlike any other to which I have had the opportunity of giving detailed study. It certainly does not appear to be at all close to any other species of Balanocarpus and, although its fruits are somewhat akin to those of Hopea (Pierrea) pachycarpa (Heim) Sym., it differs in too many respects from that species to be grouped along with it as Heim would have it. Balanocarpus Wrayi King was based upon a collection of immature fruit of B. Heimii and is no longer upheld as a species.

King's last species, *Balanocarpus Hemsleyanus* was recognised by its author to have affinity with certain species of *Shorea* but was placed in *Balanocarpus* solely on account of its fruit. Foxworthy is undoubtedly correct in placing this species in the *Brachyptera* section of *Shorea*.

In 1918 Foxworthy added two Philippine species to the genus Balanocarpus. B. brachypterus is clearly a close relative of B. Curtisii King which, as I have indicated above, should naturally be included in a group of Hopea containing H. myrtifolia Miq. and H. bracteata Burck. B. cagayanensis Foxw. was unlike any Balanocarpus then described, but again, the character of wingless fruit was allowed to overshadow the fact that the flowers are almost identical with those of Hopea philippinensis Dyer and the many other characters that these species have in common. Hopea philippinensis Dyer, usually referred to the Euhopea section of Hopea, I consider to belong to a group apart which I shall call the Pierrea group because Hopea (Pierrea) pachycarpa

^{*} B. Curtisii King has been united with H. bracteata Burck by Merrill [Journ. Str. Br. R. As. Soc. special no.: 407 (1921)], a union which I venture to question.

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(Heim) Sym. is one of its members (vide my notes on H.

pachycarpa, p. 30).

Ridley made further additions to the genus. In 1920 he added Balanocarpus ovalifolius, described from one flowering and one sterile sheet from Penang. The first is clearly Hopea intermedia King (?=H. Beccariana Burck) and the second is Shorea Maxwelliana King. In 1922 Ridley added B. pubescens which so closely resembles Hopea pachycarpa (Heim) Sym. that careful study is required to separate them. This clearly should be included in the Pierrea group.

The most recent additions to *Balanocarpus* have been made by Foxworthy who, in 1932, described as *B. pahangensis* a plant clearly related to *B. multiflorus* (Burck) Sym. which, as I have stated, would be most happily placed along with *S. Faguetiana* Heim in *Shorea*. At the same time Foxworthy described as *B. ovalifolius* a plant, distinct from Ridley's *B. ovalifolius*, but almost indistinguishable from

B. brachupterus Foxw.

I have not yet had the opportunity of examining authentic material of *Balanocarpus sphaerocarpus* Heim, *B. bancanus* Bærl., nor *B. sibogae* Bærl., all very imperfectly known species, but sufficient has been said to indicate that the disruption of the genus *Balanocarpus* is imminent and that it will be possible to distribute its members among

various groups of Hopea and Shorea.

I am inclined to think that the work of Heim in his "Recherches" sometimes shows a keener appreciation of the natural grouping of the species usually relegated to the genus Balanocarpus than does that of his critics. It is, however, undoubtedly true that Heim's excessive subdivision was premature and, as Burkill [Journ. R. As. Soc. Mal. Br. 3: 6 (1925)] has remarked, his work "needed, and still needs much further prosecution in order to establish it". Trimen, King, Brandis, and Foxworthy, who have contributed largely to the motley collection of species now included in Balanocarpus, have all expressed dissatisfaction with the genus. Handicapped by the inadequacy of their material as they so often were, they were probably wise to leave the disruption of the genus until more complete material was available.

Of recent years, not only has herbarium material of the *Dipterocarpaceae* accumulated rapidly, but many of the species formerly known only from an incomplete herbarium sheet, are now known intimately as jungle trees. The suggestions I have made above are prompted mainly by the examination of external morphological characters of old and recent material but have not a little support from anatomical data and from observations in the field. When this has been supplemented and the careful work on the embryo and seedling development carried out by Burkill has been correlated with these observations, then the suggested change may be executed, but meanwhile it seems desirable to maintain the polymorphous genus *Balanocarpus* provided it is recognised as merely a temporary arrangement of convenience.

Balanocarpus longiflorus (Brandis) Foxw., MS., comb. nov.:

'Hopea longiflora Brandis in Journ. Linn. Soc. 31:
63 (1895): Balanocarpus grandifolius Ridl. MSS. in
Herb. Kew. Plate VII.

As Brandis's description is rather brief and was based on flowering material only I have prepared the following with the additional help of Igon 00342 and Richards 2441.

Branchlets pale or reddish-brown, coarsely lenticellate, puberulous when young. Leaves narrow oblong—lanceolate or long lanceolate tapering gradually from near the base to the acuminate apex, base rounded or sub-cordate, usually about 24 cm. × 4.5 cm. but sometimes proportionately broader, margins revolute, glabrous on both surfaces, dull olive green above, shining yellow-brown beneath, very coriaceous; midrib depressed above; secondary nerves 12-15 prs., very conspicuous on the lower surface; reticulations fine, inconspicuous above, distinct beneath; petioles sulcate, rugulose, puberulous, black, about 1.3 cm.; stipules caducous, not seen. Panicles axillary, glabrous, dark-coloured, 1 or 2 main branches irregularly racemose, ultimate branchlets with 1-5 unilateral flowers. Flowers elongate pointed in bud, over 1 cm. long including the pedicel (1.7 cm. in Hav. 2120); pedicel 2 mm. long, glabrous or sparsely puberulous. Sepals sub-equal (3 inner slightly broader than the 2 outer) deltoid obtuse or broadly ovate acute, glabrous or sparsely puberulous. Petals much contorted in bud, linear, slightly fimbriate along the inner margin, puberulous along the outer portion exposed in bud, "brownish purple" (Richards). Stamens 15, pairs alternating with single stamens, of 3 sizes; anthers oval; filaments linear, flattened, broader at the base, several times longer than the anthers; appendage to connective filiform, 1-2 times as long as the anther, erect in bud, later becoming deflexed with the anthers. Ovary globose, glabrous, surmounted by an elongate-conic stylo-podium which tapers gradually into the glabrous style; stigma minute, obscurely 3-lobed. Fruit: sub-sessile; receptacle woody, glabrous; calyx lobes equal, embracing the lower portion of the nut but quite free from it, deltoid. obtuse, 8 mm. high, papyraceous above, thickened below,

striated, glabrous; nut long elliptic, sharp pointed at apex,

6 cm. × 1.7 cm., glabrous.

The earliest collections of this species examined by me are Haviland 2120 and 2254 from Kuching. Upon the former, which bore fully expanded flowers, Brandis based his Hopea longiflora in 1895. The latter has young flower buds and has been given the MS. name of Balanocarpus grandifolius by Mr. Ridley. In the absence of fruit and with the limited knowledge of the systematic groups within the Dipterocarpaceae then possible, Brandis placed the species in the Euhopea section of Hopea. In 1926 a fruiting collection (00342) was made in Setapok F. R., Sarawak, by Dr. Foxworthy's collector. A sheet of this was examined by Foxworthy who identified it with Hopea longiflora Brandis and suggested the transference to the genus Balanocarpus.

The genus Balanocarpus of King, Brandis and others is not a natural genus [vide my notes under Balanocarpus (p. 26)], and I am therefore reluctant to add yet another species to so heterogeneous a group, but until the classification of the species in all genera concerned is revised upon a more natural basis efforts must be concentrated upon grouping together those species that are clearly related to one another. Of the species examined by me Balanocarpus maximus King appears to be the closest relative of Hopea longiflorus which is therefore transferred to the genus Balanocarpus. Whether these species should remain generically distinct from Shorea macrantha Brandis, S. Hemsleyana King and some other species in the Brachyptera section of Shorea is a question upon which I

am not yet prepared to give an opinion.

Collections examined—

SARAWAK: Haviland 2120 (Auth. spec. of *H. longiflora* Brandis) & 2254 (auth. spec. of *B. grandifolius* Ridl.

MS.); Foxworthy's No. (Igon) 00342.

P. W. Richards 2441; Gunong Balapau, Ulu Tinjar, c. 800–900 m., primary forest; 2nd Nov. 1932; flower. Field note—"Medang tiong. Tree 26.7 m. high. Calyx greenish yellow; corolla lobes brownish purple".

Hopea pachycarpa (Heim) Symington, comb. nov.: Pierrea pachycarpa Heim in Bull. Soc. Linn. Paris 2: 958 (1891) et Recherch. Diptéroc. 78 (1892) Pl. 7; Brandis in Journ. Linn. Soc. 31: 113 (1895) in nota; Merr. in Journ. Str. Br. R. As. Soc. special no. 408 (1921); Gilg. in Nat. Pflanzenfam. 2nd edit. 21: 263 (1925) in nota: Pierreocarpus pachycarpa Ridl., MSS. in Herb. Kew. Plate VIII.

Branchlets pale tawny tomentose with decurrent Leaves elliptic-oblong or oblong—lanceoelevate lines. late, gradually tapering to the long acuminate apex, base slightly unequal, usually rounded on sub-cordate on one side, acute on the other, sub-revolute, about 15-20 cm. × 4-7 cm., glabrous except for the midrib and secondary nerves, drying a milk-chocolate colour on both surfaces or slightly glaucescent beneath; midrib strongly elevate and tomentose above, slightly elevate and puberulous beneath; secondary nerves 10-14 prs. at an angle of 45° to the midrib, slightly depressed and puberulous above, strongly elevate and fugaceous tomentose beneath; tertiary nerves joining the secondaries in numerous more or less parallel lines, hardly distinguishable on either surface; petioles about 0.7 cm., thick, rugulose, tawny tomentose; stipules caducous (not seen). Panicles of 2-3 racemes fascicled in the leaf axes: racemes 3-4 cm. long, black, glabrous, lax; ultimate branchlets about 6 mm. apart, subtended by minute deltoid caducous stipular bracts, each bearing 3-4 sub-secund flowers about 5 mm. apart subtended by caducous bracteoles. Flowers eval in bud, 4.5 mm. long including the pedicel; pedicel 1 mm. long, glabrous, minutely papillose. Sepals sub-equal in size; 2 ovate, rounded or apiculate at apex, thick, glabrous, 3 oval or rotundate, obtuse mucronate at apex, thinner, minutely ciliate along the upper margin, otherwise glabrous. Petals slightly contorted in bud, oblong, erose at the top and along one margin, tomentose along one half outside. Stamens 15, pairs alternating with single stamens; anthers oval, the posterior cells slightly smaller than the anterior; filaments 2-3 times as long as the anthers, broad and flattened below, gradually narrowing to the filamentous upper portion; appendage to connective filiform, about the same length as the filament. Ovary with stylopodium shaped like an hour glass, glabrous; stylopodium puncticulate above; style short glabrous; stigma minute, obscurely lobed. Fruit (mature): stalk hardly protruding from the concavity of the enlarged sepal bases. thick, 2 mm. long, glabrous; receptacle and accrescent calvx lobes thick, woody, glabrous, black, united together and to the nut by a resinous cement, forming a 5-lobed cupule, about 2 cm. high × 1.7 cm. broad; nut ovate-conical, mucronate, glabrous, shining, covered with a pale yellow resinous coating; pericarp woody, thickened in the apical portion and splitting readily into 3 equal portions to one of which the placenta is attached. *Embryo*: cotyledons collateral, the dorsal exceeding the placental and alone reaching the apex of the ovary, markedly lobed; radicle medial, erect, directed into the apex of the ovary.

Pierrea pachycarpa was described by Heim from a single specimen with immature unfertile fruit (Becc. 3314) and made the type of a new genus Pierrea. The inadequacy of the material for the foundation of a new genus is, of course, obvious, and no published information has since been added to our knowledge of the species except that Brandis remarked that it "seems to stand nearest to Balanocarpus and Shorea".

The first and only known flowering collection of this species is Haviland 2251*. This was identified with Heim's plant by Mr. Ridley who proposed (MSS. in Herb. Kew) to rename the genus *Pierreocarpus*, *Pierrea* Heim being invalidated by the earlier homonym *Pierrea* Hance (1877), now reduced to a section of *Homalium* Jacq.

A sheet of Hav. 2251 from the Kuching Museum, in a better state of preservation than the Kew sheet, has enabled me to give a description of the inflorescence and flowers, while Igon (Foxworthy's collector) No. 00207 has provided

excellent material with mature fertile fruits.

The assignation of this plant to the genus Hopea requires some explanation. Pierrea pachycarpa Heim belongs to a group of dipterocarps including the following:—Hopea philippinensis Dyer (1878), Hopea mindanensis Foxw. (1911), Balanocarpus cagayanensis Foxw. (1918), Balanocarpus pubescens Ridl. (1922), probably Hopea papuana Diels (1922)†, and Hopea laxa Sym. (1934). These form an essentially homogeneous group with tomentose branchlets, slightly inæquilateral leaves, pronounced secondary nerves joined by numerous obscure tertiaries, flowers in solitary or fascicled glabrous racemose panicles, sepals nearly glabrous. petals erose at the apex, 15 stamens with broad filament bases and long filiform appendages, glabrous ovaries shaped somewhat like an hour glass, and minute stigmas. The fruits are apparently more diverse, those of the species referred to Hopea having two calvx lobes developed into wings, those relegated to Balanocarpus (as Pierrea pachycarpa itself) having no such wings. The nut of all species is, however, essentially the same. The lower portion is enclosed in the thickened sepal bases which are closely appressed to it. pericarp is hard and woody, very thick in the apical portion, and splits readily along three lines of weakness into three equal portions, to one of which the placenta is attached. The cotyledons are erect and collateral, the dorsal is slightly

^{*} The Kew sheet bears young fruits and flowers that are detached from the leaves; the sheet in the Kuching museum has no fruits but the flowers are attached.

[†] Hopea papuana Diels is known to me only from a drawing of the type kindly communicated to me by Dr. van Slooten.

larger than the placental, and the radicle is medially placed

and directed into the apex of the ovary.

The first of the above species to be described was H. philippinensis Dver. Certainly this plant has sufficient in common with H. odorata Roxb. and its closest allies to justify its inclusion in the genus Hopea but I would not include it in the section Euhopea as Heim, Brandis and others have done. I prefer to consider it along with the species listed above as belonging to a distinct "Pierrea" group (vide my notes on Balanocarpus, p. 26). To this group Hopea pachycarpa (Heim.) Sym. belongs.

Collections examined-

SARAWAK: Becc. 3314 (Auth. spec. of Pierrea pachycarpa Heim.); Haviland 2251; Foxworthy's No. (Igon)

Hopea laxa Symington, sp. nov. Plate IX.

Affinis H. pachycarpa (Heim) Symington sed foliis majoribus multinerviis, paniculis longioribus laxioribus, pedicellis longioribus differt.

Branchlets pale tawny tomentose with decurrent lines elevate for 1-2 cm. Leaves oblong or elliptical—oblong, gradually tapering to the acute apex, base slightly unequal, rounded on one side and sub-acute on the other, slightly revolute, about 27 cm. × 8 cm., glabrous, pale yellow-brown or with a green tinge on both surfaces and sometimes glaucescent beneath (v.s.); midrib elevate on both surfaces; secondary nerves 13-17 prs. at an angle of 45° to the midrib, slightly depressed above, with traces of barbate domatia in their axes beneath; tertiary nerves fine and parallel. numerous, distinguishable only on the under surface; petioles 1.2 cm., thick rugulose, tawny tomentose; stipules linear sub-falcate, 5 mm. long, puberulous, persistent. Panicles of 2-3 racemes fascicled in the leaf axes; racemes up to 18 cm. long, black, glabrous, lax; ultimate branchlets 2 cm. apart, subtended by sub-falcate tomentose stipular bracts of which the lower sometimes persist; each bearing 4-5 flowers 1 cm. apart, arranged spirally or tending to be secund and subtended by caducous bracteoles. Flowers ovate in bud, 8 mm. long including the pedicel; pedicel 2 mm. long, glabrous, sparsely papillose. Sepals sub-equal in size and shape, ovate-deltoid, obtuse, the inner three sparsely ciliate along the apical margin, otherwise glabrous. Petals slightly contorted in bud, oblong, erose at the top and along one margin, tomentose along one half outside. Stamens 15, pairs alternating with single stamens; anthers oval, the posterior cells slightly smaller than the anterior; filaments 1-2 times as long as the anthers, broad and flattened below,

narrowing abruptly to the filamentous upper portion; appendage to connective filiform, as long as or longer than the filament. *Ovary* with stylopodium shaped somewhat like an hour glass, glabrous; stylopodium puncticulate above; style short. glabrous; stigma minute, obscurely 3-lobed. *Fruit* unknown.

Hopea laxa belongs to a group of Hopea which I have called the "Pierrea" group (vide this paper pp. 27 & 32). Hopea pachycarpa (Heim) Sym. seems to be its closest relative but it has much in common with all the members

of the Pierrea group.

Being known from flowering material only, it is not possible to predict with absolute certainty the form of the fruits of this species, because some of its nearest relatives in the *Pierrea* group have fruits of the two-winged *Hopea* type while others have fruits of the wingless *Balanocarpus* type. The very slight differentiation of its sepals in flower, however, indicates that the fruits will probably be of the latter type. The species of this group producing fruits of the *Hopea* type, that I have examined, may be detected by a marked dissimilarity in the sepals even in bud.

Collections examined—

SARAWAK: P. W. Richards No. 2361 (Type of *H. laxa* Sym.); Dulit, under 300 m.; 29th Oct. 1932; flower. Field Note—*Medang kuning*. Crest of ridge, primary forest. Tree, 24 m. high, 5 cm. (?) diam. Traces of buttresses".

Hopea sp.

P. W. Richards No. 1836; Ulu Koyan, c. 900 m., white sand ("heath") forest; Sept. 15th, 1932; young fruit. Field note—"Luis bukit. Fruit deep crimson. Tree, 30 cm. diam. No buttresses. Bark reddish, smooth, without

fissures. c. 20-25 m. high. Timber used."

This collection, which bears very young fruit, is clearly of a species of *Hopea* belonging to the section *Dryobalanoides*. I am of opinion that it represents an undescribed species but owing to the limited material and the fact that diagnostic characters within this section are so difficult to define, it seems prudent to await further collections before attempting to describe a new species.

In leaf Richards 1836 is very close to collections of *Hopea Pierrei* Hance from Cambodia and I should be sorely tempted to refer it to that species were it not that the fruit appears to have a slightly longer pedicel and that to find this species in Borneo would be surprising. Brandis and others do actually record *H. Pierrei* from Borneo, but this is on the strength of the misidentification by Brandis of

Beccari 2504 and 3050 which are, I consider, *H. Dyeri* Heim. With this exception no dipterocarp has as yet been recorded from both Indo-China and Borneo.

Vatica dulitensis Symington, sp. nov. Plate X.

V. pallida Dyer et V. albiramis V. Sl. similis sed foliis lanceolatis acuminatis, laciniis calycis fructiferi omnino reflexis quam nuce multo longioribus distinguenda.

Branchletsglabrous, grey-brown, becoming ferruginous puberulous towards the ends. Leaves lanceolate acuminate, base rounded, usually about 8 cm. × 2 cm. but may be up to 10 cm. \times 3.5 cm., glabrous, when dry shining light red-brown or greenish yellow above, paler and dull beneath; midrib slightly elevate above, strongly elevate and pale vellow beneath; secondary nerves about 14 pairs, at an angle of 45° to the midrib, yellow beneath, with frequent short intermediary nerves and reticulations conspicuous on both surfaces; petioles 0.8 cm., puberulous, black; stipules minute, caducous. Panicles terminal and axillary (rarely extra-axillary), branching irregularly from the base, up to 5 cm. long, minutely ferruginous tomentose; ultimate branchlets up to 1.5 cm. long, each bearing 2-5 spirally arranged flowers 1.0-2.0 mm. apart. Flowers oblong in bud. 8 mm. long including the pedicel; pedicel 2 mm., ferruginous stellate tomentose. Calyx cup less than 1 mm. high; lobes apparently valvate, equal, deltoid, obtuse, 0.6 mm. long, tomentose outside, puberulous inside. Petals hardly contorted in bud, oblong, rounded at apex, tomentose outside except at base, puberulous on the upper half inside, "creamy white" (Richards, 1343). Stamens 15, in pairs opposite the sepals, solitary opposite the petals; filaments short, very broad and flattened at the base; anthers almost as short, posterior cells much smaller than the anterior; appendage to connective conical, blunt. Ovary sub-globose, stellate tomentose; style about as long as the ovary, glabrous; stigma, a smooth conical crown consisting of 3 conical lobes. Fruit (nearly mature?): stalk 6 mm. long, puberulous; receptacle thin, disc-like, not enclosing the nut; accrescent calyx lobes reflexed and curved, sub-equal, elliptical or elliptic-oblong, obtuse, about 2.2 cm. \times 0.8 cm., fugacious ferruginous tomentose, with 5 inconspicuous longitudinal nerves, "greenish-yellow, suffused with brown" (Richards); nut globular, apiculate, 0.5 cm. diam., ferruginous tomentose, obscurely marked with 3 lines—probably the lines of cleavage on germination of the fruit.

Vatica dulitensis belongs to the sub-genus Isauxis (Arn.) Brandis. It seems to me to have more in common with V. pallida and V. albiramis than other species on

account of the curved and reflexed fruiting calyx lobes, but its fruits are quite distinct from any hitherto described.

Collections examined—

SARAWAK: P. W. Richards No. 1343; Dulit, under 300 m.; Aug. 19th, 1932; flower. Field note—"Resak tiong or resak bukit. Primary forest on summit of steep-sided ridge. Tree, 87 ft. high, diam. 15". Almost unbuttressed. Bark smooth with a few narrow longitudinal splits, 34" thick. Wood yellowish. Corolla creamy white. Peduncles reddish brown. Fruit R. 2543. Fls. with sickly sweet scent. Timber useful. Resin when kept for some months used for torches".

Native Collector No. 2543; Dulit, under 300 m.; Nov. 10th, 1932; fruit. Field note—"Resak tiong or resak bukit. Primary forest. Tree 11.7 m. high, 24 cm. diam. Wings of fruit greenish—yellow, suffused with brown, reflexed. Fruit of same species as an earlier number (1343) from neighbouring tree".

Cotylelobium flavum Pierre, Fl. For. Cochinch., t. 258A (1891); V. Sl. in Bull. Jard. Bot. Buitenz. III, 12, pt. 1: 44 (1932); Cotylelobium asperum V. Sl. in l.c. III, 10: 401, fig. 3 (1930).

P. W. Richards No. 2715; Gunong Santubong (1st Division), c. 300 m., low rain forest on rocky mountain side; Dec. 1932; young fruit. Field note—"Fallen branch from tree, probably of moderate size. Fruit pale green, wings bright crimson. Leaves coriaceous, yellow brown beneath."

Distribution—Borneo.

C. flavum has been reported from the Malay Peninsula by Brandis, Ridley, van Slooten, and others as a result of the misidentification of Ridley 4630 and other collections of C. malayanum V. Sl. Van Slooten corrected the error in January 1932 after study of the type material concerned, but later Foxworthy (Mal. For. Rec. 10: 246) again recorded the species from the Peninsula on the evidence of four collections from Kuala Kemaman. I am of opinion that these collections also are C. malayanum and that there is no evidence of the occurrence of C. flavum Pierre outside Borneo.

Corrigenda

Notes on Malayan Dipterocarpaceae I [Gdns. Bull. S. S. Vol. VII, pt. 2 (1933)].

p. 133—C. F. 27801 cited under Shorea platycarpa Heim is S. palembanica Miq. and should be inserted after C. F. 5696 on p. 142.

p. 150—Under Shorea hopeifolia (Heim) Sym. add the typonym Hopea hopeifolia V. Sl. in Bull. Jard. Bot. Buitenz. III, X, 3: 396 (1929).

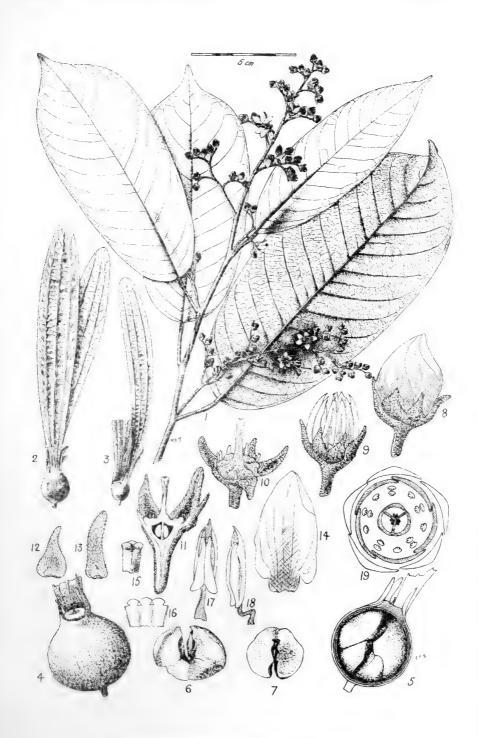
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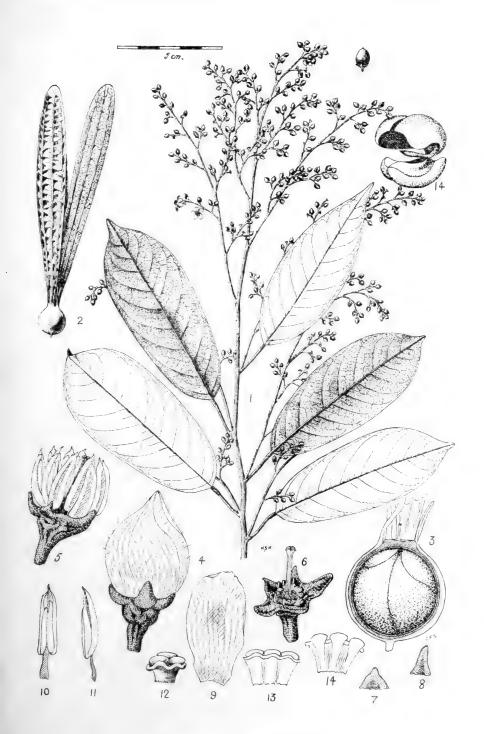
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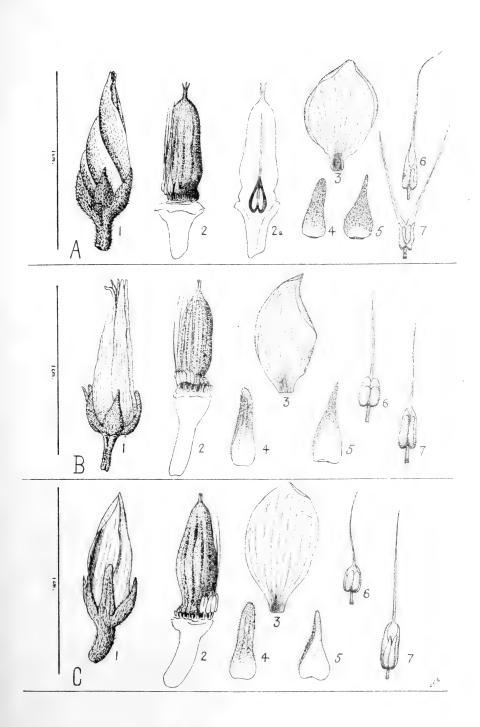
Anisoptera scaphula (Roxb.) Pierre





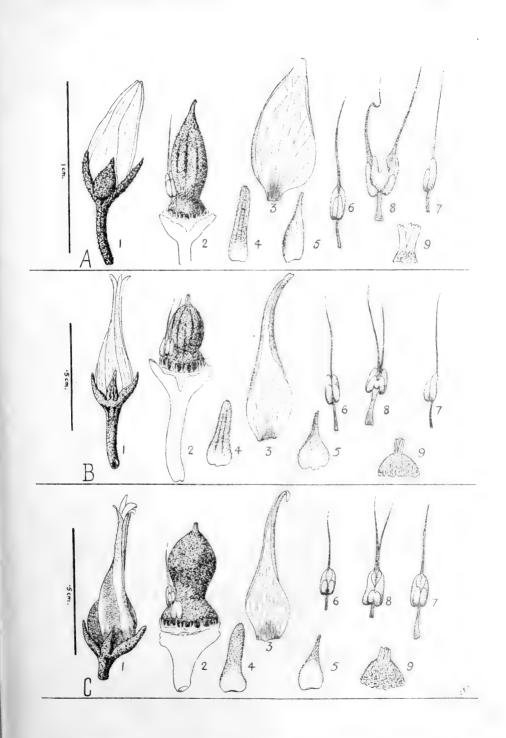
Anisoptera laevis, Ridl.





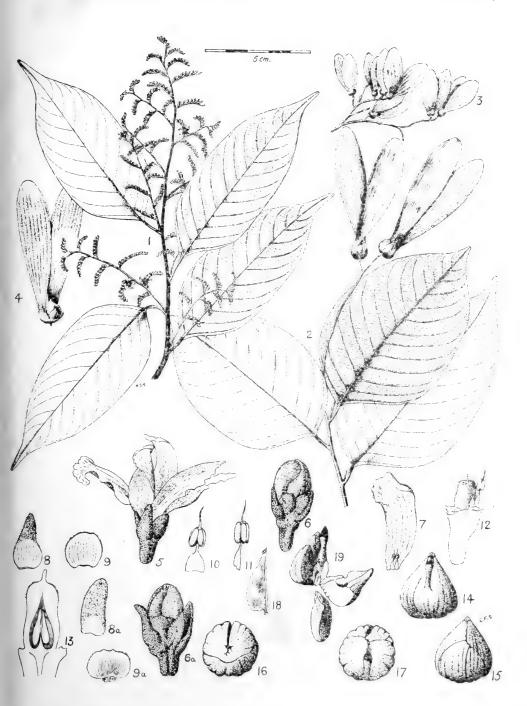
A. Anisoptera costata, Korth., B. Anisoptera oblonga, Dyer,C. Anisoptera marginata, Korth.





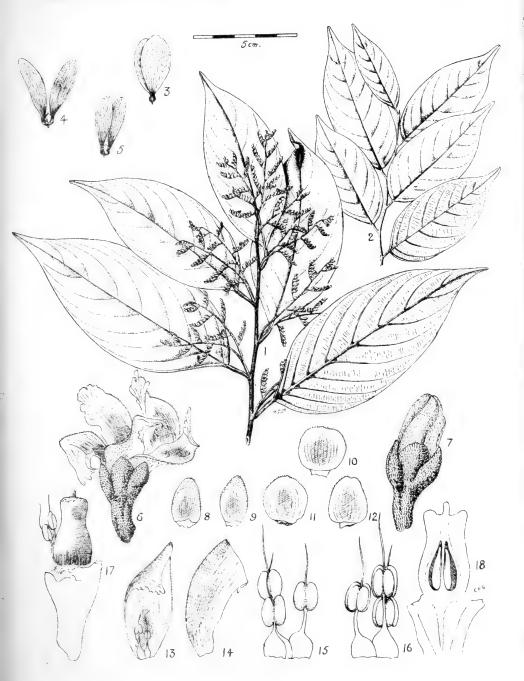
A. Anisoptera megistocarpa, V. SI., B. Anisoptera Curtisii, Dyer,
C. Anisoptera thurifera (Blco.) Bl.





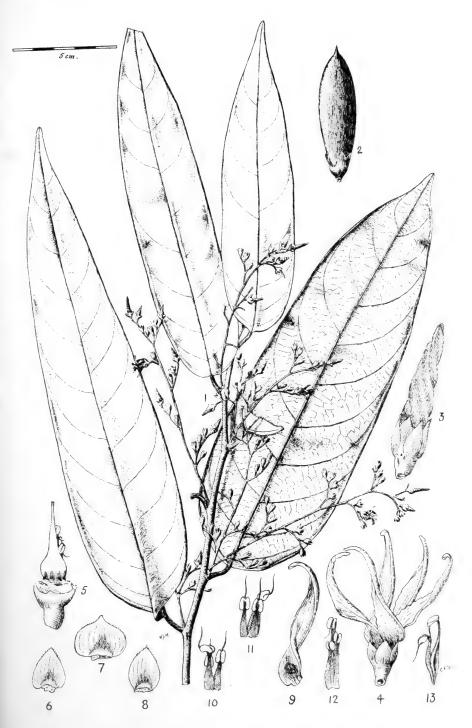
Hopea sangal, Korth.





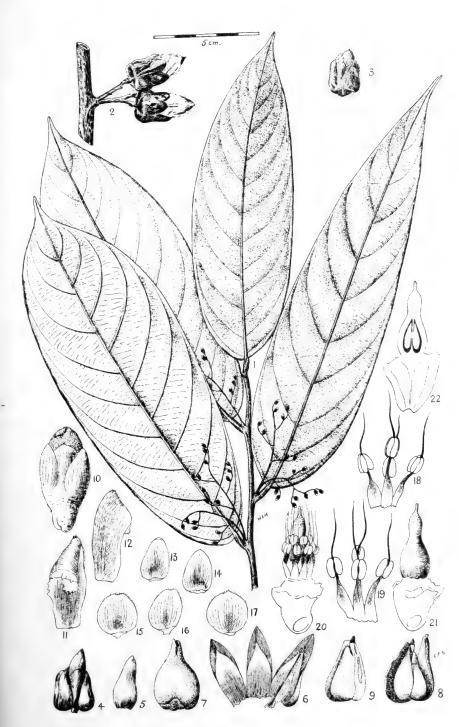
Hopea semicuneata, Sym.





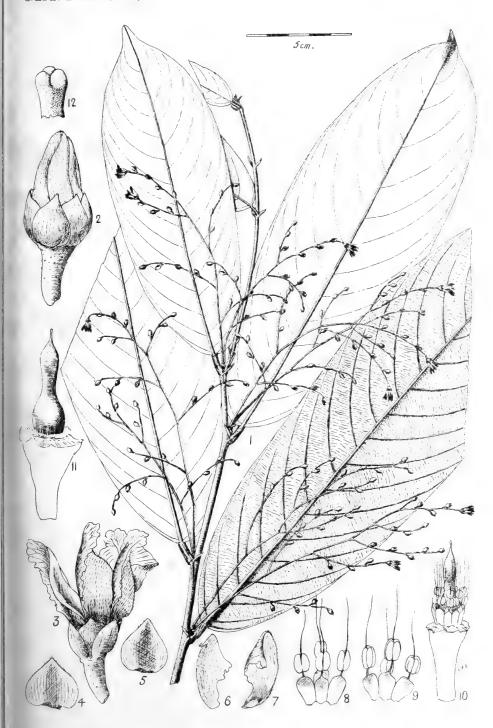
Balanocarpus longiflorus (Brandis) Foxw.



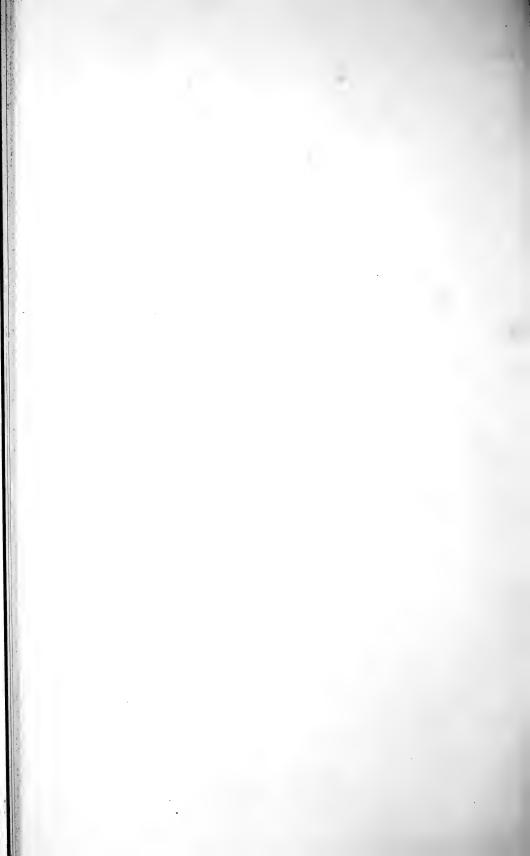


Hopea pachycarpa (Heim) Sym.





Hopea laxa, Sym.





Vatica dulitensis, Sym.





Vatica dulitensis, Sym.



EXPLANATION OF PLATES

Flate I. Anisoptera scaphula (Roxb.) Pierre. 1, flowering twig. 2, ripe fruit. 3, immature fruit. 4, mature nut. 5, mature nut—embryo exposed. 6, upper cotyledon & radicle. 7, lower cotyledon detached. 8, flower bud. 3, flower bud—petals removed. 10, flower—petals and anthers removed. 11, section thro' ovary. 12 & 13, sepals. 14, petal from mature flower. 15, stigma. 16, stigma dissected to show lobes. 17 & 18, stamens from mature flower. 19, floral diagram. (flower drawings based mainly on C.F. 30807; fruit on C.F. 631 & 21735; drawings based mainly on C.F. 30807; fruit on C.F. 631 & 21735;

Scale applies to 1, 2 & 3 only.

Plate II. Anisoptera laevis Ridl. 1, flowering twig. 2, ripe fruit. 3, fruit with cotyledons exposed 4, flower bud. 5, flower bud—petals removed. 6, flower bud—petals and anthers removed. 7 & 8, sepals

from mature flower. 9, petal from expanded flower. 10 & 11, stamens from expanded flower. 12, stigma. 13 & 14, stigma dissected. (drawings based on C.F. 647) Scale applies to 1 & 2 only.

Flate III. A. Anisoptera costata Korth. (drawings based on F.R.I. No. T. 396). B. Anisoptera oblonga Dyer (drawings based on C.F. 30133).

C. Anisoptera marginata Korth. (drawings based on Herb. Bog. Cult. IX D.171). In flower hade about to one. 2.1 with persents. Cult. IX-D-171). 1, flower buds about to open. 2, 1 with perianth parts removed. 2a, section thro' ovary and stylopodium. 3, petals from expanded flowers. 4, large sepals. 5, small sepals. 6 & 7, stamens (7a=abnormal double stamen). Scales apply to 1 only. Plate IV. A. Anisoptera megistocarpa V. Sl. (drawings based on C.F. 16624). B. Anisoptera Curtisii Dyer (drawings based on C.F. 11662).

624). B. Anisoptera Curtisii Dyer (drawings based on C.F. 11002). C. Anisoptera thurifera (Blco.) Bl. (drawings based on For. Bur. Phil. 707). 1, mature flower buds. 2, 1 with perianth parts removed. 3, petals from 1. 4, large sepals. 5, small sepals. 6 & 7, stamens. 8, abnormal double stamens. 9, styles. Scales apply to 10 only. Plate V. Hopea sangal Korth. 1, flowering twig. 2, twig with fruit almost mature. 3, immature fruit. 4, mature fruit. 5, expanded flower. 6 & 6a, flower buds. 7, petal from expanded flower. 8 & 8a, large sepals. 9 & 9a, small sepals. 10 & 11, stamens. 12, ovary & stylopodium. 13, section thro' ovary & stylopodium. 14, embryodensal view. 15 embryo nlacental view. 16, embryo from below. dorsal view. 15, embryo-placental view. 16, embryo from below. 17, embryo from above. 18, placenta. 19, embryo-one lobe of each cotyledon detached. (Drawings 1 & 5-13 based on C.F. 15147; 2 based on S'p. 3473; 3 based on C.F. 26501; 4 based on Wray 816; 6a, 8a & 9a based on H.B. 5951; 14-19 based on C.F. sine no.) Scale applies to 1-4 only.

Plate VI. Hopea semicuneata Symington. 1, flowering twig. 2, twig from seedling. 3, immature fruit. 4 & 5, fruit more mature than 3. 6, expanded flower. 7, flower bud. 8 & 9, outer sepals. 10, 11 & 12, inner sepals. 13 & 14, petal from bud. 15 & 16, stamens. 17, ovary & stylopodium. 18, section thro' ovary & stylopodium. (Drawings 1 & 6-18 based on C.F. 4526; 2-5 based on C.F. 24644). Scale applies to 1-5 only.

Plate VII. Balancarpus longiflorus (Brandis) Foxw. 1, flowering twig. 2, ripe fruit. 3, flower bud. 4, expanded flower. 5, ovary. 6, 7 & 8, sepals. 9, petal from expanded flower. 10 & 11, stamens from bud. 12 & 13, stamens from expanded flowers. (Flower drawings based on Hav. 2120 & Rich. 2441; fruit on Igon 00342.) Scale applies to

Plate VIII. Hopea pachycarpa (Heim) Symington. 1, flowering twig. 2, mature fruits. 3, immature fruit. 4, mature fruit—resinous coating removed. 5 & 6, nut from mature fruit. 7 & 8, embryo. 9, embryo—one lobe of each cotyledon removed. 10, flower bud. 11 & 12, petals. 13 & 14, outer sepals. 15, 16 & 17, inner sepals. 18 & 19, stamens. 20, flower bud sepals & petals removed. 21, ovary. 22, section through ovary. (Drawings of twig & flower parts based on Hav. 2251; fruit & embryo based on Igon 00207). Scale applies to 1-5 only.

Plate IX. Hopea laxa Symington. 1, flowering twig. 2, flower bud. 3, expanded flower. 4, inner sepal. 5, outer sepal. 6 & 7, petal from bud. 8 & 9, stamens. 10, flower—sepals & petals removed. 11, ovary & stylopodium. 12, stigma. (Drawings based on Richards 2361). Scale applies to 1 only.

Plate X. Vatica dulitensis Symington. 1, flowering twig. 2, twig with fruit almost mature. 3, expanded flower. 4, flower bud. 5, flower bud—petals removed. 6, sepals. 7 & 8, petals from expanded flower. 9 & 10, stamens from flower bud. 11, anther from mature flower. 12, stigmatic parts removed from the sheath-like style. 13, nut—embryo exposed. 14, embryo. (Drawings of flower parts based on exposed. 14, embryo. (Drawings of flower parts based on Richards 2543). Scale applies to 1 & 2 only.

THE GENUS SELAGINELLA IN THE MALAY PENINSULA

By A. H. G. Alston, British Museum (Natural History).

Only one account of the Selaginellas of the Peninsula has yet been published, that of H. N. Ridley in Journ. R. Asiatic Soc., Straits Branch, no. 80 (1919). Thirty-seven species were enumerated there, a number which is now reduced to twenty-five. In this paper the view is taken that the species shew a considerable range of variation, especially in the size of the leaves. The shape and marginal cilia of the leaves are, however, relatively constant.

S. Ridleyi Bak., S. rivalis Ridl., S. cuprea Ridl., S. alutacia Spring and S. Morgani Zeiller are apparently endemic, though the last two species are closely related to species from the Archipelago.

Thanks are due to the authorities at Kew, Singapore, Paris, Leyden, Edinburgh and Brussels for the loan of The following abbreviations are used to indicate the herbaria in which the specimens are located. BM=British Museum (Natural History), B=Jardin Botanique, Brussels, E=Royal Botanic Gardens, Edinburgh, G=Conservatoire Botanique, Geneva, K=Royal Botanic Gardens, Kew, L=Rijks Herbarium, Leyden, P=Museum d'Histoire Naturelle, Paris, S=Botanic Gardens, Singapore.

The dates of the publications on the voyages of Bélanger, d'Urville, Duperry and Freycinet have been adapted from a paper by Sherborn and Woodward in Ann. Mag. Nat. Hist. ser. 7, VII, pp. 388-392 (1901).

Sporophylls uniform:

Main stems creeping looting at intervals:
Lateral leaves entire or subentire:
Lateral leaves chate:

Lateral leaves usually strigose on the upper surface, rarely overlapping: Lateral leaves glabrous, overlapping: Lateral leaves rounded at apex:

Median leaves strongly ciliate Median leaves ciliolate

Lateral leaves subacute at apex Main stems rooting in the lower half: Main stems scandent; leaves entire; steles 3 or more:

Axillary leaves small, oblong-lanceolate; ali leaves iridescent Axillary leaves large, orbicular

Main stems erect or suberect: Lateral leaves at base of main stem distant, erect adpressed, usually uniform:

1. S. Mayeri

4. S. strigosa

2. S. Ridleyi 3. S. rivalis

15. S. atroviridis

7. S. Willdenowii 8. S. padangensis

Lateral leaves entire: Axillary leaves large, overlapping branches: Strobili usually 2-3-nate; axillary leaves not auricled Strobiii solitary: 9. S. polystachya axillary strongly auricled 10. S. plana Axillary leaves not overlapping branches; strobili solitary; axillary leaves at most slightly auricled: Pinnæ ovate; pinnulæ distant Pinnæ lanceolate; pinnulæ crowded, 11. S. delicatula usually simple 12. S. Wallichii Lateral leaves ciliate or ciliolate: Median leaves margined: Median leaves not margined: 13. S. argentea Upper margin of lateral leaves not auriculate 14. S. peltata Upper margin leaves auriculate of older lateral 15. S. frondosa Lateral leaves of main stem spreading, strongly dimorphous, usually crowded: Median leaves acuminate, white margined; lateral leaves ovate-lanceolate 6. S. repanda Median leaves usually long mucronate; Lateral leaves ovate-lanceolate; stems often stoloniferous: 5. S. selangorensis Lateral leaves oblong-lanceolate, entire or ciliolate: Stems stoloniferous 16. S. Griffithii Stems never stoloniferous: Lateral leaves strongly ciliate and enlarged at base 17. S. Roxburghii Lateral leaves entire to ciliolatedentate: Lateral branches 1-2 forked Lateral branches pinnate: 18. S. ascendens Lateral leaves slightly decurrent at base, entire 19. S. cuprea Lateral leaves rounded at base; denticulate 20. S. atroviridis Sporophylls dimorphous: Stems prostrate: Lateral leaves denticulate
Lateral leaves ciliate at base;
Median leaves ciliolate; median leaves ½
length of lateral leaves 21. S. minutifolia 22. S. alutacia Median leaves entire or denticulate; median leaves 2/3 length of lateral leaves 23. S. ciliaris Stems erect or suberect: Lateral leaves broadly ovate 24. S. Morgani Lateral leaves oblong-lanceolate 25. S. ornata

 S. Mayeri Hieron. in Engl. u. Prantl., Nat. Pfl. I, 4, p. 700, no. 343 (1901).

S. calcarea Ridl. in Journ. R. As. Soc., Str. Br., no. 80, p. 149, no. 4 (1919).

S. merguina "Spring"; Ridl. l.c. p. 149, no. 7.

?S. semicordata (Wall.) Spring in Mart. Fl. Bras. I, 2, p. 122 (1840).

?S. Mettenii A. Br. App. Ind. Sem. H. Berol. 1867, p.l.

S. Schildei Hieron. ex. v.A.v.R. Mal. Fern Allies p. 198 (1915); Mal. Ferns and Fern Allies. Suppl. I, Corr. p. 38 (1917).

S. speluncae v.A.v.R. in Bull. Jard. Bot. Buit., ser. 3, V. p. 229 (1922).

SINGAPORE: Mayer 532 (K.); Tanglin Barracks, Ridley 5830 (BM.).

Pahang: Telom, Ridley 13987 (BM.K.); Gua Tipus, Henderson 22552 (BM.); Kuala Bertam, on rock, Kiah 23953 (BM.); Gunong Senyum, on bare limestone rock, c. 400 ft., Henderson 22230 (BM.); Tembeling, Holttum 24728 (BM.); limestone country near Chigar Perah, Henderson (BM.); Gunong Senyum, Henderson 22322 (BM.).

SELANGOR: Klang Gates, Ridley 13444 (K.), 13443 (BM.K.); Bukit Kayu Kapun, Ridley 10634 (K.); Batu Caves, Ridley 13445 (K.); Gua Batu, Ridley 8772 (K.), 8151 (BM.K.); Ginting Peras, Ridley 7827 (K.); Ulu Gombak, Ridley (K.); Caves, Kuala Lumpur, Ridley 1680 (BM.K.), 1697 (BM.). Bukit Hitam, Ridley 7816 (K.); Rawang, Ridley 7820 (K.).

PERAK: Temengoh, Ridley 14474 (K.); Taiping Hills, Ridley 11472 (K.); Tanjong Malim, Ridley 11857 (K.).

KELANTAN: Kuala Aring, Yapp 75 (K.); Sungei Keteh, Batu Papan, Md. Nur 12081 (BM.).

PENANG: Stone Quarry, Chetty Temple, Curtis (S.K.); Waterfall, Curtis 1736 (S.K.).

NEGRI SEMBILAN: Bukit Tangga pass, Ridley (K.).

Geographical Range: Burma, Sumatra.

There is a fragment of Mayer's type in Hb. Kew. S. calcarea Ridl., from Batu Caves (Ridley 8772), appears to be only a small state of this species. S. Mettenii A. Br., described from plants growing in the Leipzic Botanic Gardens is very similar but has narrower lateral leaves. S. semicordata (Wall.) Spring, originally described from Nepal, is also closely allied but is rather smaller. Probably they are only forms of this species, but more material is required from India for certainty.

The Bukit Timah locality given by Ridley must be a mistake as Ridley 8151 has two labels in Hb. Kew, in Hb.

Mus. Brit. it is labelled "Gua Batu Woods" only.

This seems to be a limestone species.

S. Ridleyi Bak. in Ann. Bot. VIII, p. 131, no. 58 (1894);
 Ridl. in Journ. R. As. Soc., Str. Br., No. 80, p. 148, no. 1 (1919).

MALACCA: Gunong Mering, Mt. Ophir, on rocks in stream, Ridley 3346 (K. type; BM.).

Geographical Range: Endemic.

3. S. rivalis Ridl. in Kew Bull. 1924, p. 266.

SELANGOR: Ulu Gombak, Ridley (K. type, BM.).

PAHANG: Kuala Teku, Seimund 417 (S.). PENANG: Government Hill, Ridley (BM.).

Geographical Range: Endemic.

Vol. VIII. (1934).

S. strigosa Bedd. in Kew Bull. 1911, p. 192, No. 600;
 Ridl. in Journ. R. As. Soc., Str. Br., No. 80, p. 149 (1919).

SELANGOR: Klang Gates, *Ridley* 13442 (BM.K.), 13446 (BM.K.); Ginting Bidai, *Ridley* 7815 (K.), 7825 (K.).

Geographical Range: Endemic.

Hairs on the surface of the leaves are very rare in Selaginellæ and are only found in S. hispida (Willd.) A. Br., S. trachyphylla A. Br., S. Lindenii Spring, S. scabrida Ridl., besides this species. It is probable that it is not always a good character and that this is a form of S. selangorensis Bedd.

5. S. selangorensis Bedd. ex Ridl. in Journ R. As. Soc., Str.

Br., No. 80, p. 148, no. 3 (1919).

S. microdendron Ridl. l.c. p. 150, no. 9 non Bak. (1885). SELANGOR: Semangkok Pass, Ridley 12040 (type K.).

PAHANG: Sungei Tahan, nr. Kuala Teku, 500 ft., on rock by river, *Holttum* 20800 (S.).

PENANG: Penang Hill, Ridley 7085 (K.); Western Hill, 2,500 ft. on wet rock, Holttum 19312 (K.).

var. ciliata var. nov.

Foliis lateralibus latioribus, basi longe ciliatis.

PERAK: Taiping Hills, Ridley 14463 (BM. type, K.).

KEDAH: Kedah peak, Ridley 5174 (K.), 3,000 ft., Robinson & Kloss 6097 (K.).

Geographical Range: Endemic.

6. S. repanda (Desv.) Spring in Gaudich, Voy. Bonite Bot. I, p. 329 (1844-6).

Lycopodium repandum Desv. ex Poir Encycl. Suppl.

III, p. 558 (1814).

L. barbatum Kaulf. Enum. Fil. p. 18 (1824).

Selaginella barbata (Kaulf.) Spring in Bull. Acad. Brux. X, p. 226, no. 101 (1843).

L. tetragonostachyum Wall. Cat. no. 124 (1829) nomen; Hk. & Grev. in Hk. Bot. Misc. II, p. 398, no 129 (1931).

S. tetragonostachya (Wall.) Spring in Bull. Acad. Brux. X, p. 234, no. 163 (1843).

S. plumosa forma tetragonostachya (Wall.) Haines Bot.

Bih. & Or. p. 1224 (1924).

L. tetragonostachyum major Hk. & Gr. in Hk. Bot.

Misc. II, p. 389 (1831).

S. pyrrhopus Spring Monogr. II, in Mem. Ac. Belg. XXIV, p. 114, 115 (1850) in syn. sub S. radicata suberectu Spring.

Lycopodioides barbatum (Kaulf.) O. Ktze. Rev. Gen.

p. 826 (1891).

L. suberectum (Bak.) O. Ktze. l.c. p. 827.

MALACCA: Griffith (K. type of S. suberecta Bak.).

PENANG: Lowe (E.).

PERLIS: Ridley 14770 (S.).

Geographical Range: Philippines, Formosa, Siam,

India, Java, Sumbava, and Timor.

Lycopodium repandum was described from Philippine material by Desvaux. It was reduced to L. barbatum Kaulf., by Sprengel, Syst. Veg. IV, p. 17 (1827), who was followed by Spring, and re-examination of the type in Hb. Paris confirmed this identification. The type of L. barbatum was collected in the Philippines by Chamisso. L. tetragonostachyum Wall. was collected in Burma by Wallich, while the var. major was described from three collections. S. radicata suberecta was based on several Indian specimens. S. plumosa Hamiltonii Bak., was based on S. semicordata J. Scott (non Spring).

7. S. Willdenovii (Desv.) Bak. in Gard. Chron. 1867, pp. 783, 950.

Lycopodium Willdenovii Desv. ex Poir, Encycl. Suppl.

III, pp. 540, 552, no. 87 (1814).

L. caespitosum Blume Enum. Pl. Jav. II, p. 270, no. 23 (1830).

S. caespitosa (Blume) Spring in Bull. Ac. Brux. X,

p .140, no. 33 (1843).

S. Willdenowii Linden Cat. No. 8, p. 15 (1853) nomen. Lycopodioides Willdenowii (Desv.) O. Ktze. Rev. Gen. p. 827 (1891).

Lycopodium laevigatum Willd. Sp. Pl. V, p. 45, no. 66

(1810) non Lamk. (1791).

Selaginella laevigata (Willd.) Spring in Mart. Fl. Bras.

I, 2, p. 125, no. 13. (1840) non Baker (1867).

 \overline{S} . caesia arborea Hort. Angl. ex Kunze Ind. Fil. p. 124 (1856).

S. uncinata arborea Mett. Fil. Hort. Lips. p. 124 (1856). S. altissima Kl. ex [W. Lauche] Verz. August. Garten

p. 8 (1856) nomen.

S. arborea Hort.; Dippel in Amtl. Ber. Deutsch Naturf.

XXXIX, p. 145 (1865).

S. arborescens Hort.; Russow in Mém. Ac. Imp. Pétersb., sér. 7, XIX, p. 176 (1873).

S. Willdenowii caesia arborea (Hort) Hieron. ex. R.

Bonap. Notes Pterid. II, p. 30 (1915).

S. Willdenowii forma typica v.A.v.R. Mal. Ferns and

Fern Allies Suppl. I, Corr. p. 40 (1917).

"Common all over open country, forest edges and cleared spaces in forest"—Ridley l.c. p. 155.

Geographical Range: Sunda Is. and Indo-China.

S. caespitosa (Bl.) Spring is a monstrous state of the "witch's-broom" type; it is found in Java; Zollinger 81A (L.), Salak, Blume (L.). Sumatra:—Palembang, Praetorus (L.). There is an unlocalised specimen from Malaya (Yapp 45) in Hb. Kew shewing both forms on the same stem. Similar formations are found on S. Vonroemeri v.A.v.R. from New Guinea collected by Kloss (BM.) S. pentagona Spring from the Khasia Hills (Griffith, K.), S. Parkeri (Leng 196; Jenman) Gr.) Spring an unidentified species from the Solomon Islands at Kew. A witch's broom found on S. monospora Spring in Sikkim (Anderson 1404, Gamble 8004, Clarke 27401 and Treutler) has been described as a new species S. microclada Bak. These formations are probably due to a fungus.

8. S. padangensis Hieron. in Hedw. L. p. 34, no. 23 (1910).

S. inaequalifolia "Spring"; Ridl. in Journ. R. As. Soc.,

Str. Br., no. 80, p. 154, no. 19 (1919).

S. caudata "Spring"; Ridl. l.c. p. 155, no. 22. SELANGOR: Ginting Simpah, Hume 9386 (S.). PAHANG: Tembeling, Holttum, 24696 (BM.).

KELANTAN: Sungei Keteh, Batu Papan, Md. Nur 12079

(BM.).

PERAK: Temengoh, Ridley 14467 (BM.); Goping, King's Collector 474 (K.); Telok Pinang, nr. Ipoh, Ridley 9570 (K.); Chanderiang, King's Collector 5781 (K.).

Geographical Range: Sumatra.

The Sumatra specimens have slightly broader bracts but do not appear to differ otherwise. S. inaequalifolia appears to be confined to the hills of Assam and South India.

 S. polystachya (Warb.) Hieron. in Engl. u. Prantl. Nat. Pfl., I, 4, p. 702, No. 362 (1901).

S. Wallichii polystachya Warb. in Monsunia I, p. 106 (1900).

S. permutata Hieron. in Hedw. L. p. 24, no. 19 (1910).

S. illustris Ridl. in Journ. R. As. Soc., Str. Br., No. 80, p. 154, no. 18 (1919).

NEGRI SEMBILAN: Bukit Tangga, Ridley (K.); Gunong

Angsi, Md. Nur 1536 (K.BM.), Winkler 1772 (BM.).

SELANGOR: Semangkok, *Ridley* 8772 (K.); Sempang, *Ridley* 15630 (K.); Ginting Simpak, 1,500 ft., *Hume* 8850 (S.); Ginting Bidai, *Ridley* 7819 (K.); Semangkok Pass, *Ridley* (K.).

PAHANG: Tahan River, Ridley 2172 (BM.K.); Sungei

Cheka, Holttum 24770 (BM.).

KELANTAN: Pasir Depok, Haniff and Nur 10212 (K.); Kuala Aring, Yapp 29 (K.).

PERAK: Gunong Kerbau, Robinson 3500 (K.); Goping, King's Collector 516 (K.); Temengoh, Ridley 14467 (K.), 14459 (BM.).

var.?

Plant more slender; stem leaves smaller. often spreading; spikes usually solitary.

PAHANG: Gunong Tahan, Wray & Robinson 5414 (BM.K.); Kuala Teku, Seimund (K.).

SELANGOR: Cheras, Ridley 8195 (K.); Kanching, Ridley (K.).

PERAK: Batang Padang, King's Collector 7764 (K.).

Geographical Range: Sumatra.

This species is probably the same as S. stipulata (Bl.) Spring. S. Kittyae v.A.v.R. and S. axillifolia v.A.v.R. are also very close.

10. S. plana (Desv.) Hieron. in Engl. u. Prantl. Nat. Pfl. I, 4, p. 703, no. 363 (1901).

Lycopodium planum Desv. ex. Poir. Encycl. Suppl. III,

p. 554, no. 98 (1814).

L. Durvillaei Bory in Duperry Voy. Bot. t. 25 (1829) excl. descr.

S. perelegans Moore in Gard. Chron. XI, p. 533 (1879). JOHORE: Pulau Aor, Henderson 18365 (BM).

Geographical Range: Sumatra, Java, Timor, Amboina, Bauda, Ceram, and Bouru.

Commonly cultivated in most tropical countries and

found as an escape in Trinidad.

Bory's plate of L. Durvillaei was drawn from La Billardière's Amboina specimen and represents this species; the Rawak specimen collected by Gaudichaud is S. Pouzolziana (Gaud.) Spring and the one from Port Praslin, collected by Burville is the species to which the name S. Durvillaei (Bory) A. Br. is usually applied. The dates of publication are in Ann. Mag. Nat. Hist., ser. 7, VII, p. 392.

11. S. delicatula (Desv.) Alston in Journ. Bot. LXX, p. 282 (1932).

Lycopodium delicatulum Desv. ex Poir. Encycl. Suppl.

III, p. 554, no. 99 (1814).

Selaginella Pouzolziana (Gaudich.) Spring in Bull. Ac. Brux. X. p. 145 (1843); Warb. Monsunia I, p. 121 (1900).

Lycopodium Pouzolzianum Gaudich. in Freyc. Voy. Bot. I, p. 257 (1828).

S. canaliculata Baker in Journ. Bot. XXIII, p. 21 (1885) pp. excl. syn. Linn.

S. flaccida (Bory) Spring in Bull. Ac. Brux. X, p. 145,

no. 77 (1843).

L. flaccidum Bory in Bél. Voy. Bot. II, p. 9 (1834).

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Lycopodioides flaccidum (Bory) O. Ktze. Rev. Gen. p. 826 (1891).

Lycopodium curvatum Dalz. in Hk. Kew Gard. Misc.

IV, p. 114 (1852) non Sw. (1801).

Selaginella semicordata "Spring"; Ridl. in Journ. R. As. Soc., Str. Br., no. 59, p. 234 (1911).

Lycopodium crassicaule Hk. & Gr. Enum. Fil., in

Hk. Bot. Misc. II, p. 382, no. 101 (1831).

Selaginella crassicaulis (Hk. & Gr.) Spring in Bull. Ac. Brux. X, p. 232, no. 139 (1843).

S. suberosa "Spring"; Ridl. in Journ. R. As. Soc., Str.

Br., no. 80, p. 160, no. 36 (1919) pp.

PENANG: Stone Quarry, Chitty Temple, Curtis 3380 (S.K.).

KELANTAN: Kwala Krai, Haniff and Nur 10123 (BM.K.); Bank of Kelantan R. nr. Chaning, Ridley (K.).

PERAK: Temengoh, Ridley 14467 (K.). KEDAH: Bukit Wang, in Kedah, Haniff 1202 (S.); near

Kampong Naka, c. 100 ft., Holttum 19834 (BM.).

PERLIS: Bukit Ketri, on dry rocks, *Henderson* 23116 (BM.); Besih Hangat, in half shade amongst rocks,

Henderson 22873 (BM.); nr. Kanga, Ridley (S.).

LANGKAWI IS.: Ridley 8322 (S.K.); Gunong Raya,

Ridley 15547 (S.K.), Haniff & Nur 7156 (K.).

Geographical Range: Moluccas, S. China, Siam, India.

12. S. Wallichii (Hk. & Gr.) Spring in Mart. Fl. Bras. I, 2, p. 124 (1840).

Lycopodium Wallichii Hk. & Gr. in Hk. Bot. Misc. II, p.

384, no. 106 (1831).

L. elegans Wall. List p. 6 no. 128 (1829) nomen, non Desv.

Lycopodioides elegans (Wall.) O. Ktze. Rev. Gen. I, p. 825 (1891).

S. Wallichii elegans (Wall.) Warb. in Monsunia I, p.

106 (1900).

S. cyatheoides Spring in Bull. Ac. Brux. X, p. 145, no. 76 (1843) pp.

Lycopodium mimosoides Roxb. in Cat. l.c. Journ. Nat.

Hist. IV, p. 473 no. 7 (1844).

S. Wallichii Walkeri v.A.v.R. in Bull. Jard. Bot. Buit., ser. 2, XVI, p. 51 (1914).

SINGAPORE: Wallich (K.), Norris (K.), Cantley (BM.), Walker 24 (BM.).

JOHORE: Castlewood, Ridley 12224 (K.); Batu Pahat, Ridley 11062 (K.).

MALACCA: Maingay 1835 (K.); Cuming 2398 (BM.K.); shady jungles, Pinwill (K.).

NEGRI SEMBILAN: Perhentian Tinggi, Ridley 9869 (K). SELANGOR: Sungei Buloh, Burkill 11870 (BM.K.); Ginting Sempah, Ridley, Robinson & Kloss (K.); Ulu Gombak, Ridley (K.); Fraser Hill, on ground in jungle, Burkill & Holttum 8819 (K.) Gua Batu, Ridley 8134 (K.), Ulu Langat, Kloss (BM.).

TRENGGANU: Kuala Berang, in shade near stream,

Holttum 15324, a branched form (K.).

KELANTAN: Sungei Keteh, Md. Nur 12094 (K.); Chaning woods, Ridley (K.). Kota Bahru, in Rahmar jungle,

Gwynne-Vaughan 550, branched form (K.).

(K.); Hill PERAK: Goping, King's Collector 561 Garden, Larut, Wray 23, branched form, (K.); Taiping, Hervey (BM.); Temengoh, Ridley 14450 (BM.); Bukit

Rengas, Fox (BM.).

PENANG: Hills of Penang, Lobb 160 (K.), 2,000 ft., Lobb (BM.); Ara Kuda, Ridley 6860 (BM. K.); Penang Bukit, Curtis 3058 (K.); Penang, Wallich 128 pp. (BM.K.), Dalhousie (K.), Curtis (BM.), Birch (BM.).

Geographical Range: Indo-China, Sumatra.

S. Hookeri Bak., from Assam, should probably be regarded as a variety of this species; its lateral branches are usually bipinnate and the axillary leaves imbricate over the branchlets. S. megalura Hieron, (S. bidiensis Hieron.), from Borneo, is also closely allied but the ultimate branches taper below the cones, which are usually in pairs.

The variety Walkeri has rather larger ultimate pinnules and slightly differently sculptured spores; it does not seem

worth distinction.

Roxburgh's specimens of L. mimosoides Roxb. in Hb. Mus. Brit. are labelled "Ind. Orient"; they were probably collected at Penang.

13. S. argentea (Wall.) Spring in Bull. Ac. Brux. X, p. 137, no. 14 (1843); Ridl. in Journ. R.A.S., Str. Br., no. 80, p. 155, no. 21 (1919).

Lycopodium argenteum Wall. Cat. no. 127 (1829) nomen; Hk. & Gr. in Hk. Bot. Misc. II, p. 384 (1831).

Selaginella caulescens argentea (Wall.) Bak. in Journ. Bot. XXIII, p. 24 (1885); Curtis in Journ. R. A. S., Str. Br., no. 25, p. 97 (1894).

S. trinervia "Spring" fide Hieron, in Hedw. L. p. 15

(1910).

PENANG: Lady Dalhousie 96 (K), Pinwill (K.) Maingay 3216 (K.); Penang Waterfall, Curtis 3059 (K.); Norris (K.); Penang Hill, Ridley 7083 (BM.K.), 7635 (BM.), Wallich 127 (BM.) Penang Island, Wallich 127 (K.).

PAHANG: Tanjong Antan, Ridley 2166 (BM.).

Geographical Range: Siam.

The type of this species is represented by syn-types in Hb. Kew (ex Hb. Hooker) and Hb. Edinburgh (Ex Hb. Greville) with duplicates in Hb. Waitich (at Kew) and Hb. Mus. Brit.

S. argentea (Wall.) Spring is distinguished from S. caulescens (Wall.) Spring by its larger size, white-margined median leaves, ciliolate lateral leaves and distant stem leaves.

Hieronymus appears to be mistaken in referring S. trinervia to this species as neither the specimens nor the description agree with it.

14. Selaginella peltata Presl, in Abh. Bohm. Ges. Wiss., ser. 5, III, p. 582 (1844).

Selaginella bellula Ces. in Atti della R. Acad. Sc. VII,

no. 8, p. 36 (1876).

S. involvens bellula (Ces.) Hieron. in Hedw. L, p. 4 (1910).

PERAK: Jor. Haniff 14214 (K.).

Geographical Range: Sumatra, Java, Borneo, Philippines.

The type of *S. bellula* collected in Sarawak by Beccari, and presumably in the Florence Herbarium, has not been examined. This species is separated from *S. caulescens* (Wall.) Spring by its larger size and distant stem leaves.

15. S. frondosa Warb. in Monsunia I, pp. 105, 117, No. 75 (1900).

S. nutans Warb. l.c. pp. 105, 117, no. 72 (1900).

S. flabellata "Spring"; Ridl. in Journ. R.A.S., Str. Br., no. 80, p. 154, no. 24 (1919).

JOHORE: Ulu Kahang, 400 ft., Holttum 10928 (K.);

Kota Tinggi, Ridley 4140 (BM).

Pahang: Sungei Cheka, *Holttum* 24772 (BM.); Kota Glanggi, on dry jungle path, *Henderson* 22496 (BM.); west of Joara Bay, P. Tioman, *Burkill* 1138 (S.).

PERAK: Kamuning, Curtis 3309 (K.), Goping, Kunstler 558 (K.); Ulu Selama, Wray 4156 (S.); Tapah, Wray 1761 (S.).

KELANTAN: Sungei Galas at Gua Musang, Henderson 22602 (BM.), Chaning Woods, Ridley (K.).

Geographical Range: Java, Sumatra, and Nicobar Is.
There is a fragment of the type of S. nutans Warb.
"Java. ex Hb. Hillebrand" at Kew.

S. flubellata (Linn.) Spring, to which Ridley referred most of this material, is a West Indian species.

16. S. Griffithii Spring in Bull. Ac. Brux. X, p. 145, no. 80 (1843).

S. merguina Spring in Mem. Ac. Bel. XXIV, p. 81

(1850).

LANGKAWI IS.: Gunong Raya, Haniff & Nur 7191 (K.). Geographical Range: Burma, and Lower Siam.

17. S. Roxburghii (Hk. & Gr.) Spring in Bull. Ac. Brux. X, p. 228, no. 115 (1843).

Lycopodium Roxburghii Hk. & Gr. in Hk. Bot. Misc.

II, p. 390, no. 135 (1831).

Selaginella acutangula Spring in Mem. Ac. Belg. XXIV,

p. 206, no. 144 (1850).

Lycopodioides acutangulum (Spring) O. Ktze. Rev. Gen. I, p. 825 (1891).

S. trichobasis Bak. in Journ. Bot. XXII, p. 275, no. 152 (1884).

S. trichobasis strigosa Ridl. in Journ. R. As. Soc., Str. Br., no. 80, p. 153 (1919).

S. plumea trichobasis (Bak.) v.A.v.R. Mal. Fern Allies

p. 102 (1915).

S. lankawiensis Ridl. in Journ. R. As. Soc., Str. Br., no. 80, p. 150, no. 10 (1919).

S. simalurana v.A.v.R. in Bull. Jard. Bot. Buit., ser. 3,

III, p. 176 (1920).

S. langirensis v.A.v.R. in Bull. Jard. Bot. Buit., ser. 2,

XI, p. 26 (1913).

SINGAPORE: Norris (K.); Walker 307 (K.); Bukit

Timah, Ridley (BM.K.).

JOHORE: Marius Jensen (K.); Gunong Blumut, Holttum 10674 (BM.K.); Mt. Austin, Ridley 12570 (K.); Gunong Pulai, Ridley 12130 (K.); Ridley 12134 (K.); Castlewood, Ridley 9192 (K.); Patani Batu Pahat, Ridley 10984 (K.);

Kluang, Holttum 9238 (S.).

SELANGOR: Semangkok Pass, Ridley 12041 (K.); Batang Berjuntai, Ridley 7828 (K.), 15 miles Pahang Track. Ridley 8668 (K.), 8771 (K.); Klang water catchment forest Burkill 6824 (S.), Burkill and Holttum 9043 (K.); Rantau Panjang, Kloss 68 (K.); Kuala Lumpur, Hose 361 (K.); Weld's Hill, Ridley (K.); Forest Reserve, Rawang, Kloss (K.); Batang Padang, Murdoch 11963 (K.); Ginting Bidai, Ridley 7826 (K.); Batang Berjuntai F. R., Hume 7448 (K.); Semenyih, Hume 8272 pp. (S.); Ginting Simpak, 1,500 ft., Hume 9733, 9879 (BM.).

PAHANG: Wray's Camp, Gunong Tahan, Ridley (K.): Telom, Ridley 13989 (K.); Kuala Lipis, Machado 11588 (K.); Rumpin River, Evans (K.); Gunong Raja, Best 13856 (S.); Gunong Tahan, Robinson & Kloss 5361 (BM.); Sunger

Sat, Henderson 22023 (BM.); Sungei Telom, Kiah and Strugnell 23989 (BM.); Kuala Lipis, Burkill 15674 (BM.); Sungei Cheka, Holttum 24771 (BM.), 24769 (BM.).

TRENGGANU: Bundi, Rostado 11977 (K.). DINDINGS: Tanjong Hanka, Ridley 7273 (K.).

PERAK: Grik, Ridley 14466 (BM.K.); Temengoh, Ridley 14457 (BM.), 14470 (K.); Tapah, Ridley 14022 (BM.K.); Taiping, Ridley 14456 (BM.), 14450 (K.); Jor Camp, Henderson 10868 (S.).

KELANTAN: Kuala Aring, Yapp 35 (K.).

PENANG: Lobb (BM.); Wallich 120 pp., Lady Dalhousie (K.), Low (E.); Penang Hill, Ridley 14150 (K.), 14159 (BM.K.); Richmond Pool, Ridley (K.); West Hill, Ridley (BM.); Pinara Bukit, Curtis (S.).

Geographical Range: Siam, Sumatra.

The type of this species has not been found, but there is a specimen labelled *L. Roxburghii* "Penang—Capt. Low 1831" by Greville in Herb. Edinb. and in Hb. Wallich there is a specimen labelled "Lycopodium plumosum 122—1 Roxb." which is probably a duplicate of the type.

There is a galled specimen in Hb. Kew (*Ridley* 605) from Bukit Timah.

A similar gall has been seen on a specimen from Indo-China, collected by *Kloss* (BM.). *S. pentagona* Spring collected by *Griffith* in the Khasia Hills (K.), Garo Hills, *Mann* 65 (BM.) and Assam, *Mrs. Hopkinson* (BM.) referred to in Notes Pterid. XI, p. 35, is galled by a gnat (Cecidomyidæ). The gall on *S. pentagona* has been figured in Gebel's Organographie ed. 2, fig. 418.

18. S. ascendens v.A.v.R. in Bull. Jard. Bot. Buit., ser, 2. XI, p. 33 (1913); l.c. XXIII, p. 23 (1916).

SINGAPORE: Kehding 3264 (B.).

SELANGOR: 15th mile Pahang Track, Ridley 8770 (BM.K.).

Geographical Range: Borneo, Sumatra, Anamba Is.

19. Selaginella cuprea Ridley in Journ. R. As. Soc., Str. Br., no. 80, p. 152, no. 14 (1919), excl. var. major. SELANGOR: Rawang, Ridley 7822 (BM.K.).

Pahang: near Chigar Perah, Henderson 194908 (BM.K.); Wray's Camp, Gunong Tahan, Ridley 16198 (BM.K.); Sungei Cheka, Holttum 24778 (BM.); River Tahan, Ridley 2177 (BM.).

KELANTAN: Kwala Pertang, Haniff and Nur 10377

(BM.K.).

PERAK: Bujong Malacca, Curtis 3377 (K.), Ridley 9574 (K.).

Geographical Range: Endemic.

The var. major seems to be a small form of S. atroviridis.

20. S. atro-viridis (Wall.) Spring in Flora XXI, p. 183 (1838).

S. trinervia Spring in Bull. Acad. Brux. X, p. 143. no.

62 (1843).

S. plumosa Spring in Mem. Ac. Belg. XXIV, p. 136, no. 81 (1850).

Lycopodium furcatum Roxb. in Calc. Journ. Nat. Hist.

IV. p. 475 (1844).

L. atro-viride Wall. Cat. p. 6 no. 120 (1829) nomen; Hk. & Gr. Ic. Fil. 1, t. 39 (1831); in Hk. Bot. Misc. II, p. 387, no. 121 (1831).

"Common in woods"—Ridley l.c. p. 153.

SINGAPORE: Ridley 2410 (BM.), 56 (BM.), 2411 (BM.) Gaudichaud 13 (P.G.), Murton 103 (K.), Norris (K.), King's Collector 343 (K.).

Johore: Ridley (ВМ.), 1347 (К.), 11494 (К.), 11113

(K.), Jensen 84 (K.), Nur & Kiah 7797 (K.).

MALACCA: Lobb (K.), Griffith (K.), Hervey (K.).

NEGRI SEMBILAN: Winkler 1771 (BM.K.); Ridley (K.),

Kloss (K.), Nur (K).

SELANGOR: Ridley (BM.), 8669 (K.); Klang, Hullett (S.); Ginting Simpah, Hume 9603 (S.), 8837 (S.); Semenyih, Hume 8111 (S.).

PAHANG: Wray & Robinson 5366 (BM.); Holttum 20095 (BM.); Henderson 22509 (BM.); Evans (K.); Burkill & Holttum (K.); Ridley 16197 (K.); 16196 (K.).

PERAK: Ridley 9571 (K.); Curtis 3310 (K.).

TRENGGANU: Rostado 11976 (K.).

PROVINCE WELLESLEY: Ridley 12635 (K.).

PENANG: Dalhousie (K.); Robinson (K.); Macher (K.); Birch (BM.); Pinwill (K.); Ridley (K.); Maingay 2211 (K.); Curtis (K.BM.); Low 31 (K.); Wallich (BM.); Hall (BM.).

LANGKAWI IS: Robinson 6270 (K.).

Geographical Range: Sumatra, Lower Siam, and Tenasserim.

S. atro-viridis is a very variable species. The following represent varieties, some of which, on further study, may prove to be specifically distinct.

(a) S. atro-viridis var. ciliata Spring. A variety with ciliolate external leaves.

MALACCA: Griffith (K.).

(b) A luxuriant form with a thick stem and long aristate median leaves, possibly representing a distinct species.

PAHANG: Telom, Ridley 13993 (BM.), 13989 (K.).

PENANG: Penang Hill, Fox 10662 (BM.). PERAK: Taiping, Hervey 1667 (BM.).

(c) S. cuprea var. major Ridl.

This seems to be a small form of S. atroviridis; the leaves of many species vary greatly in size.

SELANGOR: Bukit Hitam, Ridley 7817 (K.).

PAHANG: Bukit Chemaga, Henderson 19480A (BM.K.); Wray's Camp, Gunong Tahan, Ridley 16199 (K.).

DINDINGS: Telok Sera, Ridley 8358 (K.).

PERAK: Ulu Temengoh, Ridley 14468 (BM.K.); Temengoh, Ridley 14469 (BM.K.); Taiping Hills, Ridley 14460 (BM.K.); Chanderiang, Larut, King's Collector 519 (K.); Bidor, near Tapah, Ridley 14016 (K.).

(d) A small creeping form, perhaps a juvenile state. Malacca: Mt. Ophir, (Tunduk), Ridley 9990 (BM.K). The species is stated by A. Braun (Ind. Sem. Berol. 1860, p. 22) to have been introduced into cultivation from Borneo by T. Lobb; this is probably an error, as no wild

specimens from Borneo are recorded.

There is a specimen in Hb. Kew labelled "Madras,

Dr. Shuter". It is probably wrongly localised.

The plant found in China and Japan is now usually considered a distinct species, S. Doederleinii Hieron.

 S. minutifolia Spring in Mem. Ac. Belg. XXIV, p. 239, no. 176 (1850).

S. Wattii "Bak.": Ridl. l.c. p. 157, no. 26. S. phanotricha "Bak." l.c. p. 157, no. 27.

"Mountains on clay banks"—Ridley.

JOHORE: Gunong Blumut, 3,000 ft., Holttum 10692 (BM.K.).

SELANGOR: Bukit Hitam, Ridley 7818 (K.); Sempang

Mines, Ridley 15633 (BM. K.).

PAHANG: Gunong Kajang, P. Tioman, 3,000 ft.,

creeping on rock face, Henderson 18279 (K.).

PERAK: Ulu Batang Padang, Ridley 13988 (BM.K.S.); Temengoh, Ridley 14472 (BM.K.); Gunong Inas, Wray 4142 (S.).

KELANTAN: Gunong Sitong, Nur 12199 (BM.K.).

Geographical Range: Burma (Mergui).

This species is allied to the Philippine S. nummularia Warb, but has more acute lateral leaves.

S. Wattii Bak. has ciliate lateral leaves and long aristate median leaves.

The identification with S. minutifolia is rather doubtful as the Mergui plant is still very imperfectly known.

22. S. alutacia Spring in Bull. Ac. Brux. X, p. 233, no. 154

(1843).

S. alutacea Spring in Gaudich. Voy. Bonite Bot. 1, p. 353 (1844-6) errore; Bak. in Journ. Bot. XXIII, p. 175 (1885).

S. pinangensis Spring l.c. p. 227, no. 107; Ridl. l.c. p.

149, no. 6 (1919).

Lycopodioides pinangense (Spring) O. Ktze. Rev. Gen. p. 827 (1891).

S. Kunstleri Bak. in Kew Bull. 1893, p. 14, no. 39.

S. Wrayi Bak. Fern Allies p. 113, no. 296 (1887). S. oligostachya Bak. in Ann. Bot. VIII, p. 132, no. 272 (1894).

S. Tansleyi Bak. in Kew Bull. 1906, p. 205, no. 420.

S. montana Ridl. in Journ. R. As. Soc., Str. Br., no. 80, p. 159, no. 33 (1919).

S. alutacea var. sphaerophylla Bak. in Journ. Bot.

XXIII, p. 175 (1883).

JOHORE: Gunong Pulai, Ridley 12137 (K.), Holttum 18076 (BM.).

MALACCA: Cantley (BM.); Gunong Mering, Ridley

3347 (type of S. oligostachya Bak., K.).

NEGRI SEMBILAN: Gunong Angsi, Ridley 11873 (K.);

2,500 ft., Nur 11562 (K.); Bukit Tangga, Ridley (K.).

SELANGOR: Damansara Hill, Kuala Lumpur, Ridley (K.); Bukit Kutu, 3,000 ft., Ridley 7829 (K.), 7824 (BM.K.); Ulu Gombak, Ridley (K.); rocks at the Tunnel, Klang Gates, Ridley (K.); Rawang, Ridley 7821 (K.); rocks at Gua Batu, Ridley 8150 (S.); Ginting Simpah, Hume 8843, 8597, 8497, 9743, 9745, 9531, 8834, 9014, 9380 (all S.); Semenyih, Hume 7906 (S.).

PAHANG: Gunong Tahan, 3,300 ft., Wray & Robinson 5363 (BM.K.), 5375 (BM.), Ridley 15954 (K.), 15959 (K.); Wray's camp, Gunong Tahan, Ridley 16200 (type of S. montana Ridley, K.); Kuala Lipis, Machado 11558 (K.); Sungei Reriang, G. Tahan on rocks by stream, Holttum

20574 (BM.).

PERAK: "Perak or Selangor", Tansley (type of S. Tansleyi Bak., K.); Taiping Hills, Ridley 11425 (BM.K.); Waterfall, Taiping, Ridley 14462 (BM. K.); Sungei Siput, Ridley 11898 (BM.K.); Ulu Temengoh, Ridley 14471 (BM.K.); Larut, 100-300 ft., King's Collector 1866 (type of S. Kunstleri Bak., K.); Taiping, Ridley 14460 (K.); Temengoh, Ridley 14465 (K.), 14464 (BM.K.), 14473 (K.BM.S.); Tapah, Ridley 14024 (BM.K.); Bukit

Kamuning, Sungei Siput, Ridley 11871 (K.), 11870 (K.); Gunong Keledang, Ridley 9576 (K.); Bujong Malacca, Ridley (BM.), 4,000 ft., Curtis 3308 (S.). Birch's Hill, Wray 668 (type of S. Wrayi Bak., (K.).

DINDINGS: Lumut, *Ridley* 10349 (K.), 7215 (K.BM.), *Curtis* (S.).

TRENGGANU: Bundi, Rostados (K.).

KEDAH: Kedah Peak, 3,000 ft., Robinson & Kloss 6098 (K.), in shade of rocks by path, Holttum and Haniff 14900 (K.).

PENANG: Gaudichaud 7 (Paris, type of S. pinangensis Spring); Lobb (BM.); Penang Hill, Ridley (K.); on banks. Pinwill (K.).

S. alutacia var. scabrida (Ridley) Alston, comb. nov.

S. scabrida Ridley in Journ. R. As. Soc., Str. Br., no. 80, p. 159, no. 32 (1919). Leaves hairy on both surfaces; stems hairy.

PAHANG: Gunong Tahan, Ridley 15960 (K.).

The type specimen is very distinct looking, but Nur 11562 (BM.) is intermediate between this and the common form.

S. alutacia var. pensile (Ridley) Alston comb. nov.

S. pensile Ridley in Journ. R. As. Soc., Str. Br., no. 80, p. 150, no. 8 (1919). An extreme form with larger, more acute leaves.

PERAK: Gunong Inas, 5,500 ft., pendent on damp shady rocks, Yapp (K.).

Ridley 15954 & 16200 connect it with the ordinary form.

S. alutacia var. Curtisii (Ridl.) Alston comb. nov.

S. Curtisii Ridley in Journ. R. As. Soc., Str. Br., no. 80, p. 148, no. 2 (1919) Lateral leaves overlapping.

Perak: Bujong Malacca, Curtis 3378 (K.S.).

S. alutacia is "dull olive green" according to Wray & Robinson (no. 5363).

The Assam plant referred to S. pinangensis by Spring is quite a different species near S. praetermissa Alston.

The Kew specimen looks distinct, but that in Hb. Singapore shows a complete transition to the common form of the species.

23. S. ciliaris (Retz.) Spring in Bull. Ac. Brux. X, p. 231, no. 136 (1843).

Lycopodium ciliare Retz. Obs. V, p. 32, no. 92 (1789).

SINGAPORE: Gallang, Ridley 10828 (K.).

MALACCA: Griffith (K.).

NEGRI SEMBILAN: Sungei Ujong, Alvins 2166 (S.).

SELANGOR: Batu Caves, Ridley (K.).

KELANTAN: Kuala Aring, Yapp 111 (K.).

Geographical Range: India to Australia.

24. S. Morgani Zeiller in Bull. Soc. Bot. Fr. XXXII, p. 78 (1885).

PAHANG: Cameron's Highlands, 5,000 ft., Holttum 23385, (BM.); top of Falls 4,800 ft. Henderson 17770 (BM.); Gunong Berumban, Ridley 13985 (K.), 13986 (K.).

PERAK: Gunong Riam, 1950m., J. de Morgan (K.); Gunong Kerbau, Robinson (K.).

Geographical Range: Endemic.

Perhaps only a form of S. alutacia Spring, but the sub-erect habit and ovate, less strongly ciliate lateral leaves, appear distinctive.

25. S. ornata (Hk. & Gr.) Spring in Bull. Ac. Brux. X, p. 232, no. 145 (1843).

Lycopodium ornatum Hk. & Gr. in Hk. Bot. Misc. III, p. 108 (1833).

S. brachystachya var. ornata (flk. & Gr.) Bak. in Journ. Bot. XXIII, p. 180 (1885).

S. polita Ridl. in Journ. Fed. Mal. St. Mus. VI, p. 202, no. 348 (1915).

S. Blumei Spring in Bull. Ac. Brux. X, p. 143 (1843).

S. fimbriata Spring in Mem. Ac. Belg. XXIV, p. 258, no. 198 (1850).

S. subfimbriata v.A.v.R. in Bull. Jard. Bot. Buit., ser. 2, I, p. 26 (1911).

S. sclerophila v.A.v.R. in Bull, Jard. Bot. Buit., ser. 3, II, p. 182 (1920).

S. varians v.A.v.R. in Bull. Jard. Bot. Buit., ser. 3, V, p. 237 (1922).

SELANGOR: Semangkok Pass, *Ridley* 12638 (K.), 12038 (K.), 12039 (K.); Sempang, *Ridley* 15631 (BM.K.).

Pahang: Telom, Ridley 13990 (K.); Kuala Teku, Seimund 860 (S.), Fraser Hill, 4,000-4,370 ft., Burkill & Holttum 8822 (K.), Nur 11020 (BM.), Henderson 11286 (S.); Gunong Tahan, 5,500-7,000 ft., Haniff & Nur 7974 (K.); Teku Woods, G. Tahan, Ridley 15958 (BM.K.), 15951 (BM.K.); Wray's Camp G. Tahan, Ridley 16195 (K.).

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PERAK: Bujong Malacca, Curtis 3379 (K.); Larut, 4-5,000 ft., King's Collector 2411 (K.), 2361 (K.), 2362 (K.); Gunong Hijau, Haniff & Nur 2459 (K.), Fox (S.); Taiping, Hervey 1678 (BM.); Maxwell's Hill, Taiping, Ridley 5181 (S.); Birch's Hill, Wray (S.).

Geographical Range: Indo-China, Sumatra, Java,

Borneo and Philippines.

The plant (Ridley 7034) referred by Ridley (l.c. p. 160) to S. suberosa Spring probably comes here.

SPECIES EXCLUDENDÆ.

S. chrysocaulos (Hk. & Gr.) Spring in Bull. Ac. Brux. X, p. 232, no. 141 (1843).

S. hypnoides Spring in Bull. Ac. Brux. X, p. 141, no. 44 (1843).

Lycopodium chrysocaulon Hk. & Gr. in Hk. Bot. Misc. II, p. 401, no. 182 (1831).

L. argenteum Wall. List, p. 6, no. 127 (1829) pp.

TYPE: Mountains of Penang, Wallich 127 (E.K.).

This species was wrongly reported from Penang, the specimens were doubtless from North India.

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Notes on the Biology of Macaranga spp., Gardens' Bulletin, S. S., Vol. VIII, part 1, October 1934.
p. 63, line 22, for "specimens" read "species".

p. 63, line 36, for "indurated to accommodate" read, "too indurated to accommodate".



NOTES ON THE BIOLOGY OF MACARANGA SPP.

By J. A. Baker, B. Sc.

Of the 225 species of Macaranga, 20 only are recorded in the Malay Peninsula. They constitute an outstanding, and often dominant, genus of secondary growth plants, sometimes occurring nearly as a pure stand, but more usually in association with other genera. Their appearance in the succession follows on the preliminary phase of Lallang (Imperata arundinacea) and Sendudok (Melastoma polyanthum), and they may be regarded oecologically as the palæotropical counterparts of the neotropical Cecropiae, both genera being characteristic of advanced secondary growth and both being "myrmecophilous". It appears that the Macarangas are distributed largely through the agency of birds (e.g. the Punai or Green Pigeon (Osmotreron vernans), which is a regular inhabitant of secondary growth and is also to a large extent responsible for the dissemination of Melastoma polyanthum (1, 2.).

STRUCTURES RELATED TO THE PRESENCE OF ANTS.

There are two features with which one may relate the intimate association of ants with many specimens of Macaranga.

These are:--

(1) Fistular stems.

(2) The presence of Food-Bodies on certain parts of the plant.

(1) Fistular Stems.

The young shoots of all species of Macaranga are solid but, as growth advances, the pith, in a number of species, dries out and degenerates, while the surrounding wood increases in thickness and hardness. Hollow internodes are consequently formed into which the ants make their way by biting small holes. The terminal internode is never thus inhabited, nor are the very old internodes, which are presumably abandoned when they become indurated to accommodate the sap-sucking coccids which are kept by the ants inside their nest.

(2) Food-Bodies.

These are white multicellular spheres, about 1 m.m. in diameter, which form one of the chief sources of food to the ants, being bitten off by them and carried into the nest (Plate XII, fig. 3). Treatment with iodine shows that

starch is not present; microscopical examination reveals globules of fat or oil which are extruded when the food-body is ruptured by pressure. These globules are soluble in chloroform.

The distribution of the food-bodies varies among different species. In M. triloba they are borne on the under surface of the stipules. These stipules are convex and strongly deflexed so as to form a hollow chamber (Plate XII, fig. 1, 2) in which the ants are completely protected while in search of their food.

In M. hypoleuca they are borne on the under surface of the leaves, the stipules in this species being lanceolate and narrow. (Plate XI, figs. 1, 2).

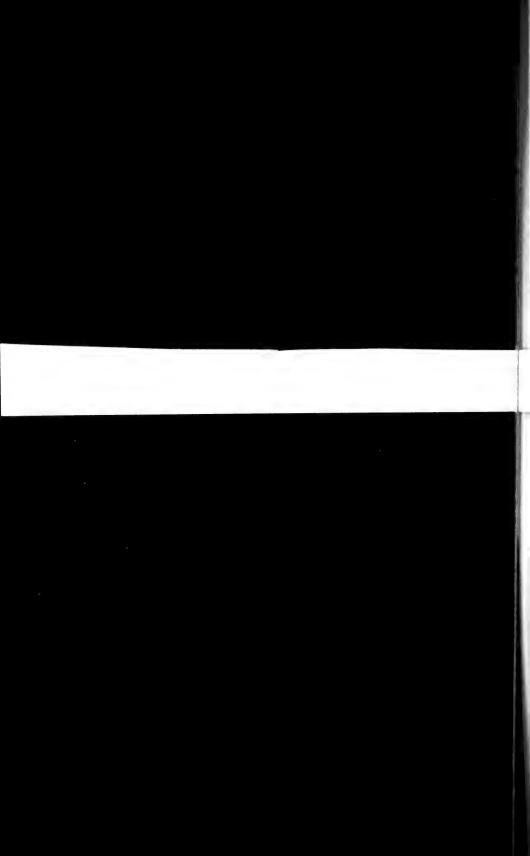
Both of these cases are described by RIDLEY (3). I find, however, that there is a third type, represented by M. Hosei and M. Maingayi, in which the food-bodies are borne only on the upper surface of the very young stipules which, in their early stages, are turned upwards and are protected by the young leaves; these latter form a canopy almost > completely surrounding the tip of the shoot (Plate XV, figs. 2, 3). [The discovery of Macaranga Maingayi, H.f. in abundance near Gersek and Sungei Ring, Johore is interest-This species was originally described from specimens collected in Malacca by Maingay and in Perak by Kunstler, and has not been found again in these localities. however, one specimen in Herb. Singapore (C. F. No. 18183) from Selangor) which is doubtfully referable to this species. Superficially it resembles M. Hosei, King, but can be distinguished readily by the peltate, not basal, insertion of the petiole. Another point of difference, noted by Mr. Baker, is that in M. Maingayi the stipules are irregularly cupshaped with the concave surface upwards, while in M. Hosei they are flat and nearly horizontal, except when very voung.—M. R. Henderson.]

M. Griffithiana and M. Kingii follow the type of M. triloba.

RIDLEY (3) is of the opinion that the food-bodies are developed from small plate-like glands (Bladder Glands), which cover the under surface of the leaves and the stipules of all the myrmecophilous species (and some non-myrmecophilous ones), but on this point I have not been able to satisfy myself.

It is to be observed that in all the cases recorded the food-bodies are placed in well-protected positions; they do not appear to be formed on the upper surface of the leaves, on the stems, or on the unprotected surfaces of stipules; their location, moreover, seems to be perfectly definite for

p. 64, line 20, for "(Plate XV, figs. 2, 3)" read "(Plate XIV, figs. 5 and 6)".



a given species. I have never yet discovered ant food-bodies on the leaves of M. triloba, nor any on the lower stipules surface of M. Hosei, nor any on the upper surface of M. Griffithiana and M. triloba. These facts might tempt one to believe that their development was in some way associated with the activities of the ants, were it not that they are indisputably formed on uninhabited, as well as on inhabited, individuals of the species which possess them.

The non-myrmecophilous members of the genus e.g. M. megaphylla, M. tanaria, M. recurvata etc., have no foodbodies, nor are their stems fistular. In M. recurvata, M. triloba, M. hypoleuca, M. Hosei, M. Griffithiana and M. Kingii the leaf veins terminate in cylindrical or club-shaped nectaries (Plate XIII, fig. 4) which are best developed in M. hypoleuca (Plate XI, fig. 5). These are functional in the young state and secrete drops of a clean sticky fluid which, curiously enough, is never touched by the ants, though nectaries on most plants are eagerly visited by the ants for the sake of their sugary secretion and, in other antplants where they occur (e.g. Acacia cornigera) they form an important source of nourishment. On one occasion. moreover, I have seen ants, of an unidentified species. drinking from the marginal nectaries of Macaranga recurvata (which is not a myrmecophilous form).

THE ANTS.

The ants regularly associated with Macaranga spp. are Cremastogaster (Decacrema) borneensis Andre. subsp. Macarangae Viehmeyer. This statement is based on specimens from M. Griffithiana, M. hypoleuca and M. triloba respectively, which were kindly determined for me by Mr. Donnisthorpe. The species proved to be identical in each case and, at the same time, corresponded exactly with specimens at the British Museum previously collected by RIDLEY in Singapore.

Having examined a large amount of material I have never found a Macaranga inhabited by any other ant. From time to time the sexual castes may be found and usually many plants in the same vicinity are found to contain these.

I have collected de-alated females both in *M. triloba* and in *M. Hosei*. In one specimen there were 3 adjacent, but unconnected, internodes, each of which contained a queen and some pupæ. In one internode some workers had hatched out, these being sensibly smaller than usual (perhaps on account of inadequate nutrition). Evidently the population of a single plant does not always derive from one queen. Nearby some specimens of *M. Hosei* also proved to contain

queens. In so far as I had examined scores of specimens from the same spot earlier in the year without finding a single female I conclude that, when the ants swarm, they settle down in some locality and enter any suitable species of *Macaranga* which is at hand. The male is a good deal smaller than the female and may be at once distinguished by its longer and finer antennæ. Whenever I have found winged males they have been lodged in the lower internodes of the inhabited shoot, the upper ones containing only workers.

Different species of Macaranga vary a good deal in the extent to which they are inhabited by ants. *M. triloba* is nearly always inhabited and *M. hypoleuca* very generally so. Specimens of *M. Hosei* on the other hand are about as often uninhabited as they are inhabited.

If two plants containing ants are tied together, or otherwise brought into contact, the inquilines engage one another in combat, after the ordinary manner of ants from different nests (their recognition of individuals from their own nest being customarily attributed to a characteristic nest-smell).

RIDLEY (3) recorded the almost universal presence of coccids in the interior of the hollow stems, but as far as I know these have not yet been determined. They are, however, of the degenerate type with greatly reduced legs, and no antennæ. He also regarded them as the only insects ordinarily associated with the ants inhabiting *Macaranga*. I note, however, that on the under surface of the leaves small jassid hoppers are frequently present, at least one species of which bears a strong superficial resemblance to *Cremastogaster*. These jassids are in no way molested by the ants and, in so far as many of the group are known to be "myrmecophilous" (as well as "ant-mimics) it may be that, like the coccids, they are solicited for their secretion.

The detritus within the stem is often teeming with minute nematode worms—a fact recorded by BAILEY (4) in analogous material from *Cordia nodosa*. This observer points to the presence of nematodes in the infrabuccal pellets of some *Pseudomyrminae* and suggests that part of the life-cycle might occur within the ant.

It is also interesting to note that uninhabited stems of *Macaranga* often form a nesting site for a small solitary vespid, determined for me by Mr. Pendlebury as a species of *Crabro*. I have found this same wasp in the stems both of *M. hypoleuca* and *M. Griffithiana*. Several of the pupe proved to be parasitised by a small chalcid.

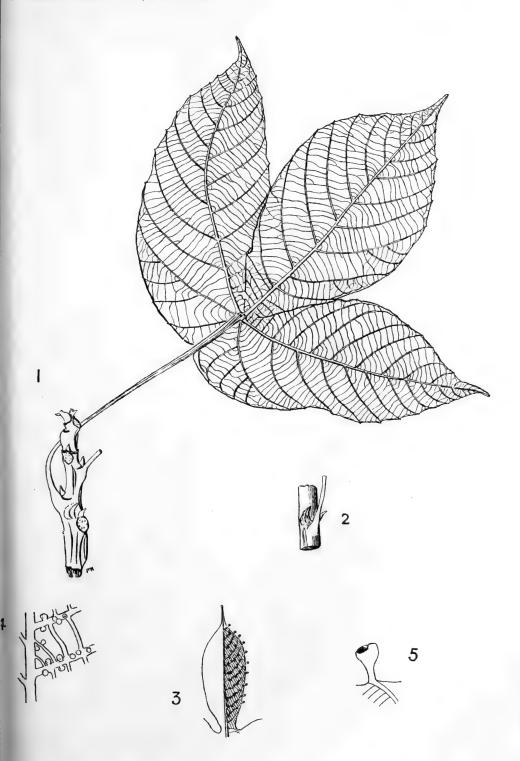
That the inquilines of myrmecopytes furnish protection to their host plants against the ravages of pests, is a contention that has been hotly disputed from the time when it was first put forward by BELT (5) in connexion with the S. American Cecropias. RIDLEY (3) concluded that the Macarangas were protected in this way against tortricid caterpillars, and all observations that I have made go to confirm this. A plant that is seriously infested with these caterpillars is almost invariably an uninhabited one. It is equally certain, however, that against many other pests the ants constitute no protection at all. Trees are often seen with their leaves severely attacked by leaf-eating insects, in spite of being inhabited by ants. In this case the parasite is presumably a flying one, in so far as there is no trace of it on the plant itself. Spherical galls are also common on the leaves and petioles of M. triloba and M. hupoleuca.

REFERENCES

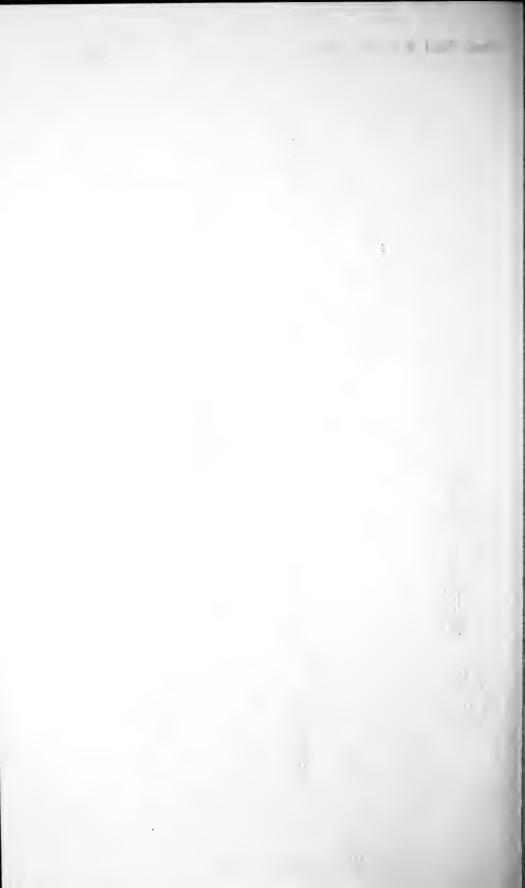
- (1) RIDLEY, H. W. "The dispersal of Plants throughout the world" 1930 pp. 487, 501, 502.
- (2) ROBINSON, H. C. "The Birds of the Malay Peninsula" Vol. I p. 9. 1927.
- (3) RIDLEY, R. W. "The symbiosis of Ants and Plants" Ann. Bot. XXIV 1910 p. 457.
- (4) Bailey, I. W. "Notes on Neotropical Ant Plants" Bot. Gaz. LXXIV No. 4, 1922.
- (5) BELT, T. "The Naturalist of Nicaragua" 1874.

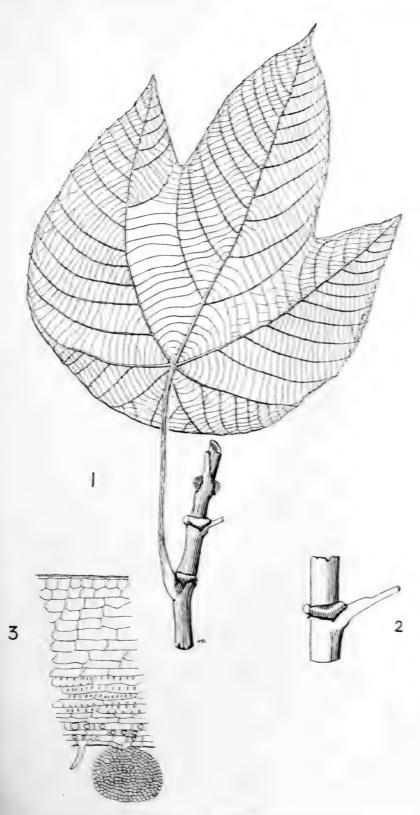
EXPLANATION OF PLATES

- Plate XI. Macaranga hypoleuca. 1. Shoot with leaf; 2. Detail of ditto showing shape and position of stipules: 3. Middle lobe of young leaf with food bodies and nectaries (under surface); 4. Detail of ditto showing insertion of the food bodies. The waxy excretion which covers the under surface of the leaf is not shown in this diagram; 5. A marginal nectary.
- Plate XII. √Macaranga triloba. 1. Shoot with leaf; 2. Detail of ditto showing deflexed stipules; 3. Usual section of stipule showing food body.
- Plate XIII. Macaranga Maingayi. 1. Shoot with leaves; 2. Detail of ditto showing stipules; 3. Middle lobe of young leaf (under surface); 4. Marginal nectary.
- Plate XIV. Macaranga Hosei. 1. Shoot with leaf; 2. Middle lobe of young leaf (under surface); 3. T.S. Stem showing stipules from above; 4. Under surface of young leaf, showing "bladder-glands" much enlarged; 5. Young stipules seen from above showing food-bodies on upper surface; 6. Tip of growing shoot showing the manner in which the food-bodies are protected by the young leaves.
- Plate XV. Macaranga Griffithiana. 1. Shoot with leaf; 2. Under surface of stipule showing food-bodies; 3. Under surface of leaf showing "bladder-glands" and wax-bodies.



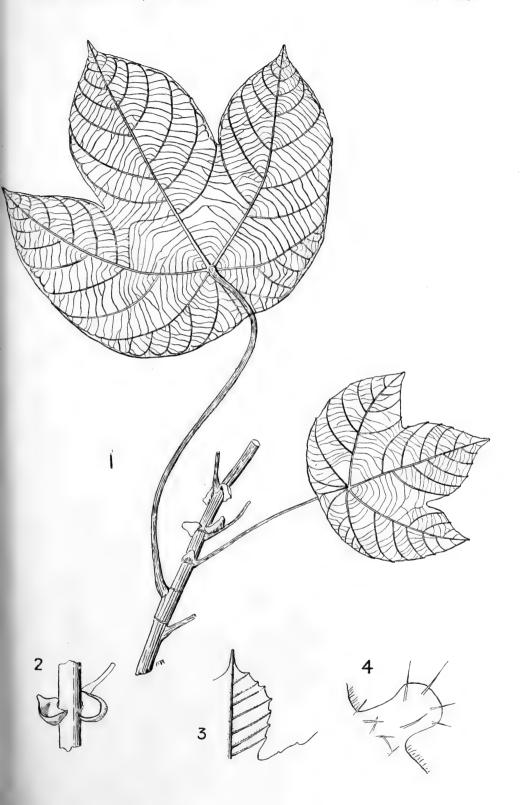
Macaranga hypoleuca





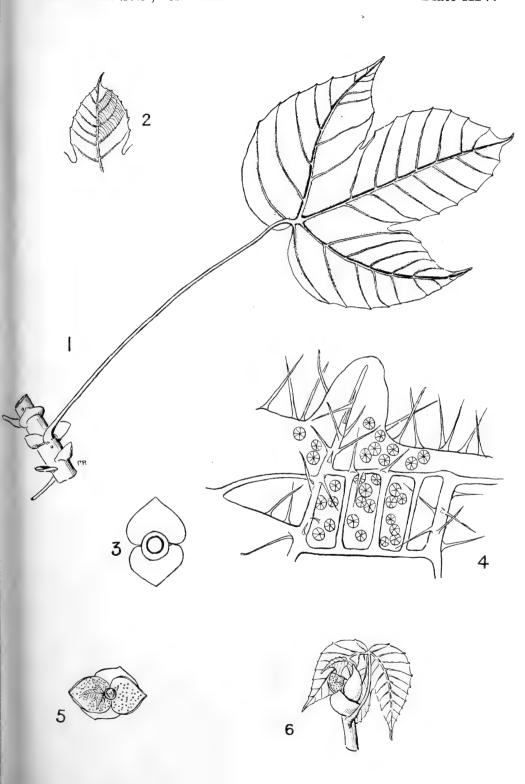
Macaranga triloba

P"



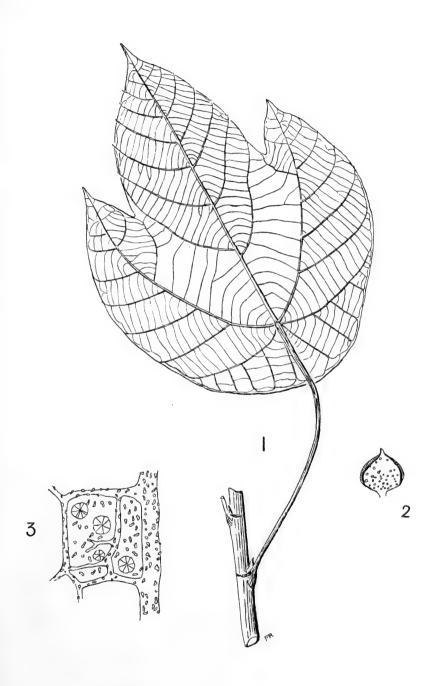
Macaranga Maingayi





Macaranga Hosei

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Macaranga Griffithiana





DEPARTMENTAL NOTICES

A list of plants which can be purchased at the Botan Gardens in Singapore and Penang can be had on application. The same list appears at intervals in the Government Gazette.

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ARDENS & BULLETIN

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THE

GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. VIII 26th January, 1935

Part 2

SOME MALAYAN ORCHIDS V.

By C. E. Carr, F.L.S.

In the present paper are enumerated the orchids collected by the Oxford University expedition to Sarawak in 1932. The expedition visited the mountains of the Fourth Division and most of the plants were collected on and around Mount Dulit at altitudes ranging from near sea level to 1,400 metres with one number at 1,900 metres. Over half the plants were found below 900 metres altitude. Collecting was carried on from the end of July until November.

The collection comprises 132 species of which 32 are found to be as yet undescribed. It has been necessary to make 4 new varieties and 1 new name. There are 6 new combinations, namely Chelonistele kutaiensis Carr (Coelogyne kutaiensis J. J. S.), Dilochia gracilis Carr (Arundina gracilis A. & S.) Trichotosia aurea Carr (Eria aurea Ridl.), T. lacinulata Carr (Eria lacinulata J. J. S.), Sarcopodium speculum Carr (Dendrobium speculum J. J. S.), and Sarcochilus indusiatus Carr (Thrixspermum indusiatum Rchb. f.).

Apart from the new species there are 18 previously known species now reported from Borneo for the first time (marked with an asterisk). Of these the most interesting are Stereosandra javanica Bl., Aphyllorchis striata Ridl., Tainia vegetissima Ridl., Liparis purpureo-viridis Burk. & Holtt., Dendrobium ustulatum Carr and Bulbophyllum foetidolens Carr.

Peristylus Hallieri J. J. S. in Bull. Dep. Agr. Ind. neerl. xxii (1909), 1; Bull. Jard. Bot. Buit. II. Suppl. t. 2, f. II.

S. 543, Ulu Koyan c. 800 m., September 22nd, 1932, P. W. Richards. "Growing among moss and Dipteris on rocks by river and probably covered when river rises. Flowers green. No scent.

Distribution:—Endemic.

Corybas Johannis Winkleri J. J. S. in Bull. Inst. Bot. Hamb. vii (1927), 14, t. 1, f. 4.

S. 449, Dulit ridge c. 1200 m., September 10th, 1932. P. W. Richards. "Growing on rocks with small herbs and moss under waterfall in moss forest. Flower dark crimsonred with cream edge and prolonged petals, white in centre of flower. Leaf pale green with prominent veins. tuberous."

2713, Gunong Santubong c. 400–700 m., December 1932. P. W. Richards. "Among moss on siliceous rocks in forest growing in groups of 4-5 plants. Flowers white marked with crimson."

Distribution:—Sumatra.

Cryptostylis acutata J. J. S. in Bull. Jard. Bot. Buit. Ser.

3, III (1921), 243; l.c. v (1922), t. 24, f. III.

S. 441, Dulit ridge at c. 1240 m., September 7th, 1932. P. M. Sunge. "On bank in moss forest. Posterior petal prominent, crimson with deep crimson spots. Labellum crimson. Column green. Two lateral petals erect. Leaves medium green with brown markings."

Distribution:—Java, Sumatra, British North Borneo. *Stereosandra javanica Bl. Mus. Bot. Lugd. Bat. II, 176;

Fl. Jav. Orch. 27, t. 10, f. 3, t. 11 G.

2315, Dulit under 300 m., October 23rd, 1932, native collector. "Saprophyte, flowers violet and white."

Distribution:—Sumatra, Java, Malav Peninsula.

Philippines, ? N. Guinea.

Lecanorchis multiflora J. J. S. in Bull. Jard. Bot. Buit. Ser. 2, xxvi (1918), 8; l.c. ser. 3. v (1922), t. 25, f. II.

S. 1, Marudi near sea level, July 25th, 1932, P. M. ge. "White sandy forest. Growing on ground as saprophyte in shade. White fringed labellum with mauve on the underside."

2241, Dulit under 300 m., October 17th, 1932, P. W. Richards. "On summit of ridge, primary forest, saprophytic. Labellum white, other inner perianth segments buff, outer perianth segments light brown to buff."

Distribution:—Java.

Aphyllorchis pallida Bl. Bijdr. (1825), Tab. f. 77.

S. 282, Dulit under 300 m., August 20th, 1932, native collector, saprophytic in primary forest.

Distribution:—Java, Sumatra, Malay Peninsula, Philippines.

*Aphyllorchis striata Ridl. Mat. i, 205.

S. 340, Dulit c. 1,500 feet altitude, August 27th, 1932, native collector. "Growing saprophytically in primary Stem fleshy, green with red flecks. Flowers not forest. open. Sheath green with red flecks. Height 3 feet."

S. 546, Dulit ridge under 300 m., September 26th, 1932, P. W. Richards. "Probably saprophytic. Stem has mauve markings, fleshy. Flowers cream, mauve stripes on 2 lateral petals. Column mauve. The flower sheath has mauve

markings. Slight sweet smell."

Distribution:—Malay Peninsula.

*Vrydagzynea tristriata Ridl. in Journ. Linn. Soc. Bot. xxxii (1896), 398.

S. 357, Dulit under 300 m., August 30th, 1932, native collector. "Rock near stream in secondary forest. Leaves velvet black with 3 prominent pink veins. Flowers tubular opening very slightly at the tip, pink at the base, cream above. No scent."

Distribution:-Malay Peninsula.

*Vrydagzynea albida Bl. Fl. Jav. n. ser. I Orch. (1858), 61, t. 20, f. 3.

S. 364, Dulit under 300 m., August 30th, 1932, P. W. Richards. "Stream bank in primary forest. Flowers green, not quite open."

Distribution:—Sumatra, Java. Malay Peninsula,

Philippines.

Zeuxine purpurascens Bl. Fl. Jav. n. ser. I. Orch. (1858), 58, t. 18, f. 3; t. 23, F. E.

S. 301, Dulit under 300 m., August 22nd, 1932, P. M. "Terrestrial near a small stream in rocky primary Leaves small with prominent pink vein down the forest. centre and very dark green lamina. Stem pale. Flowers small pale brown with green ribbed and twisted ovary."

Distribution:—Sumatra, Java.

Zeuxine (§ Hetaeriopsis) linguella sp. nov. Caulis e basi repente erectus, c. 9-folius. Folia leviter obliqua, oblongo-ovata, breviter acuminata, acuta, petiolo gracili canaliculato. Inflorescentia laxe multiflora. Bracteæ oblongo-ovatæ, longe acuminate, acutæ. Sepala extus glanduloso-pilosa. Sepalum dorsale ellipticum, obtusum. Sepala lateralia late lanceolata, obtusa. Petala e basi angustissima valde cuneata, obtusa, falcata. Labellum basi saccatum, 3-lobum, sacco intus basin versus appendicibus trilobis 2 donato dimidio superiore carinato, lobis lateralibus erectis late rotundatis, lobo intermedio porrecto lineari-oblongo obtuso. Gynostemium intus bicarinatum, rostello longe bilobo.

Stems prostrate and rooting at the base, erect and leafy above, the leafy part c. 11 cm. long, internodes up to c. 1.80 cm. long. Leaves c. 9, rather oblique, oblong-ovate, shortly acuminate, acute with a minute mucro, up to c. 5.50 cm. long, c. 2 cm. wide, petiole grooved up to c. 1.70 cm. long. Inflorescence elongate, hairy, peduncle provided with 2-3 tubular sheaths and 1 bracteiform sheath above c. 12 cm. long, rachis laxly many-flowered c. 7 cm. long. Bracts appressed to the ovary, oblong-ovate, long acuminate, acute, sparsely hairy outside with ciliate margins, c. .50 cm. long. Sepals glandular-hairy outside. Dorsal sepal elliptic, obtuse, 3-nerved, c. .55 cm. long, c. .27 cm. wide. sepals broadly lanceolate, obtuse, 3-nerved, c. .46 cm. long, c. .22 cm. wide. Petals broadly cuneate above the very narrow base, falcate, obtuse, anterior margin roundly dilate above the middle, 1-3-nerved, glabrous, c. .53 cm. long, c. .18 cm. wide. Lip porrect, saccate, 3-lobed, the sac provided inside near the base with 2 3-lobed appendages keeled in the upper half with the keel reaching to the base of the midlobe, glabrous, 5-nerved, spread out c. .43 cm. long, c. .25 cm. wide across the side lobes; side lobes erect, broadly rounded, forming with the shallow sac a subquadrate hypochile; midlobe porrect, linear-oblong, obtuse, 3-nerved c. .18 cm. long. Column, including the rostellum, c. .35 cm. tall with 2 strong keels inside below the stigmata, rostellum elongate bifid with the lobes subulate c. .12 cm. long, stigmata oblong. Anther narrowly cordate, long acuminate, acute, keeled above the triangularly obtusely bilobed base.

A distinct species well characterized by the long linear-

oblong midlobe of the lip.

S. 302, Dulit under 300 m., August 22nd, 1932, P. M. Synge. "Terrestrial on banks of rocky stream in primary forest. Leaves deep green with wide light lamina. Flowers with pink labellum. Ovary brown. Hood green. Lateral petals white."

Described from dried plants.

Cystorchis aphylla Ridl. in Journ. Linn. Soc. Bot. xxxii (1896), 400.

S. 600, Niah under 300 m., November 1932, P. M.

Sunge.

Distribution:—Sumatra, Java, Malay Peninsula, Philippines.

*Tainia vegetissima Ridl. in Journ. Linn. Soc. Bot. xxxviii 328.

Dulit ridge c. 1230 m., September 7th, 1932, P. M. Synge.

Distribution:—Malay Peninsula.

Cœlogyne (§ Longifoliæ) dulitensis sp. nov. Pseudobulbi elongato-ovoidei, graciles, bifolii. Folia oblongo-oblanceolata, acuta, breviter petiolata. Inflorescentia in pseudobulbo maturo, flores intervallis singulatim gignens. Bracteæ caducæ. Sepalum dorsale oblongum, triangulariter acuminatum, acutum. Sepala lateralia anguste oblongo-ovata, acuta. Petala anguste linearia, acuta. Labellum 3-lobum, lamina tricarinata, lobis lateralibus late et rotundatim triangularibus obtusis, lobo intermedio ex ungui brevi transverse oblongo late ovato obtuso minute apiculato.

Pseudobulbs approximate to 1 cm. distant, slenderly elongate-ovoid, a little laterally flattened, at first covered with imbricating sheaths, c. 9.25 cm. long, when dry c. .80 cm. diam. at the base c. .30 cm. wide near the apex, 2-leaved. Leaves oblong-oblanceolate, acute, thinly coriaceous with c. 5 strong nerves, up to c. 10 cm. long, c. 3.25 cm. wide, petiole grooved c. 3-ribbed c. 1.75 cm. long. Inflorescence from the apex of the mature pseudobulb between the leaves. shorter than the leaves, few-flowered, peduncle nude slender elliptic in section c. 5 cm. long c. .10 cm. diam., rachis flexuous as long with internodes .25-.55 cm. long. Bracts caducous, not seen. Flowers appearing singly at intervals. Dorsal sepal oblong, triangular -acuminate, acute, 5-7nerved, c. 2.30 cm. long, c. .70 cm. wide. Lateral sepals narrowly oblong-ovate, acute, subsigmoidly falcate, keeled on the back, 5-nerved with the outer nerves branched above the base, c. 2.30 cm. long, c. .60 cm. wide. Petals narrowly linear, subulate-acuminate, acute, 1-nerved, c. 1.90 cm. long, c. .13 cm. wide above the base. Lip 3-lobed, blade between the side lobes provided with 3 entire keels of which the median reaches to c. the middle of the blade the outer to above the base of the blade of the midlobe, spread out c. 2.20 cm. long, c. 1.25 cm. wide across the side lobes; side lobes broad, roundly triangular, very obtuse; midlobe shortly clawed with the claw transversely oblong and dilate a little upwards, blade broadly ovate obtuse minutely apiculate fleshy and transversely rugulose towards the margins the median line broadly elevate, the whole c. 1 cm. long, c. .80 cm, wide, Column arched above the middle, wings little roundly dilate from about the middle, hood rounded entire, c. 1.50 cm. tall, rostellum ovate, stigma deeply excavate suborbicular with elevate margins the anterior margin recurved. Anther ovate, grooved above, beak roundly triangular minutely retuse, c. .30 cm. long.

This is a close ally of C. kinabaluensis A. and S. but is much smaller in all parts.

S. 342, Dulit c. 2,000 feet altitude, August 27th, 1932, *P. M. Synge*. "Small tree trunk growing close to *C. exalata* Ridl. (S. 339). No scent. Labellum and hood pale pink. Column dirty white with brown tip."

Described from dried material.

Cœlogyne Endertii J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. xi (1931), 94.

S. 502, Ulu Koyan c. 900 m., September 16th, 1932, native collector. "Growing on small tree c. 10 feet from the ground. Flower petals pale green, transparent. Labellum has crimson lower edge to side ridges and blotch just above tip. Column pale pink, brown at tip. No scent."

Distribution:—Endemic.

Cœlogyne (§ Longifoliæ) planiscapa sp. nov. Pseudobulbi elongato-ovoidei, leviter lateraliter compressi, 2-folii. lineari-oblanceolata. rigida. acuta. coriacea. petiolata. Inflorescentia breviter in pseudobulbo maturo, flores intervallis singulatim gignens. Bracteæ oblongo-ovatæ, acutæ. Sepalum dorsale oblongum, a medio fere acuminatum, obtusum, minute apiculatum. Sepala lateralia ovata, acuminata, anguste Petala linearia, subacuta, obtusa, minute apiculata. minute apiculata. Labellum 3-lobum, 3-carinatum, lobis lateralibus rotundatim triangularibus obtusis, lobo intermedio ex ungui late cuneato ovato subacuto margines versus incrassato et transverse ruguloso.

Pseudobulbs up to c. 3 cm. distant, elongate-ovoid, a little laterally flattened, ribbed, covered at first with c. 4 fleshy tubular sheaths, c. 7 cm. long, c. 1.50 cm. wide at the base, c. .60 cm, wide below the apex, 2-leaved. Leaves linear-oblanceolate, acute, rigid, coriaceous with c. 5 strong nerves, up to 21.50 cm. long, c. 2.70 cm. wide, petiole grooved 4-5 cm. long. Inflorescence from the apex of the mature pseudobulb between the leaves, elongate, stout, manyflowered, peduncle strongly laterally flattened and narrowly winged narrowly elliptic in section c. 17 cm. long c. .45 cm. wide c. .12 cm. through, rachis flexuous at least 24 cm. long with internodes up to 1.60 cm. long. Bracts caducous, imbricating at the apex of the rachis, oblong-ovate, acute, up to c. 5 cm. long. Flowers appearing singly at intervals, widely expanded, the sepals 5-nerved with the outer nerves branched from the base. Dorsal sepal oblong, acuminate from c. the middle, obtuse, minutely apiculate, c. 3.10 cm. long, c. 1.28 cm. wide. Lateral sepals ovate, acuminate, narrowly obtuse, minutely apiculate, keeled outside, a little longer and broader. Petals linear, subacute, minutely apiculate, 3-nerved, c. 2.83 cm, long, c. .27 cm, wide above the base. Lip 3-lobed, the blade between the side lobes

provided with 3 entire keels which rise above the base the median low reaching to 1/3 below the apex of the blade the outer 2 tall rather thin reaching to beyond the middle of the midlobe and terminating abruptly, fleshy, spread out c. 2.75 cm. long, c. 1.30 cm. wide across the side lobes; side lobes erect, falcate, roundly oblong-triangular, very obtuse; midlobe clawed with the claw subquadrate and a little cuneately dilate upwards c. .60 cm. long, blade ovate obtusely apiculate thickened and transversely wrinkled towards the margins with the median nerve elevate near the apex, in all c. 2 cm. long. Column arched above the middle, wings gently dilate from about the middle and very shortly roundly triangular at the apex, hood little rounded subquadrate nearly truncate entire, c. 1.85 cm. tall, rostellum roundly triangular keeled above, stigma subquadrate with greatly elevate recurved anterior margin. Anther conic, beak retuse, c. .37 cm. long. Column foot distinct, c. .25 cm. long. Ovary conspicuously 6-ribbed.

This is evidently a close ally of *C. cuprea* Wndl. & Krzl. from which it is at once readily distinguished by the

vegetative parts.

S. 419 (type), Dulit ridge c. 4,000 feet altitude, September 6th, 1932, P. M. Synge. "Moss forest. Flower shell pink, tip of column brown, ridges on labellum pink."

S. 556, Dulit ridge c. 1300 m., October 5th, 1932, P. M. Synge. "Moss forest, epiphytic on small tree. Flower pale shell-pink, tip of column brown. No scent."

Described from dried material and a flower preserved

in spirit.

Cœlogyne Naja J. J. S. in Bull. Jard. Bot. Buit. Ser. 3.

xi (1931), 93.

S. 539, Dulit ridge c. 850 m., September 22nd, 1932, native collector. "Small tree in sandy forest c. 3 feet from the ground. Flowers shell pink. No scent. Leaves reddish brown."

Distribution:—Endemic.

Cœlogyne Rochussenii De Vr. Ill. Orch. (1854), t. 2; t. II, f. 6.

2212, Dulit under 300 m., October 14th, 1932, P. W. Richards. "Epiphytic on tree in secondary forest on river bank c. 5-6 m. from the ground. Six outer perianth segments pale greenish yellow, labellum white with lemon yellow markings; inner perianth segment opposite labellum white, inner lateral segments white striped with dull orange."

Distribution:—Sumatra, Java, Malay Peninsula,

Celebes, Sula Islands, Philippines.

Cœlogyne hirtella J. J. S. in Bull. Jard. Bot. Buit. Ser. 3.

xi (1931), 105.

S. 442, Dulit ridge c. 4,000 feet altitude, September 8th, 1932, *P. M. Synge*. "Small tree in transitional moss forest. Flowers white, orange stripes on ridges of labellum. Tip of column brown. Sweet scent."

S. 417, Dulit ridge c. 4,300 feet altitude, September 6th, 1932, T. H. Harrison. "Moss forest. Flowers white, labellum with orange and brown ridges, brown tip to

columns."

Distribution:—Endemic.

Cœlogyne rhabdobulbon Schltr. in Notiz. Berl. viii (1921), 15.

'2480, Ulu Koyan c. 1000 m., November 7th, 1932, P. W. Richards. "On ground on edge of clearing in 'heath' forest. Perianth white, crests on labellum dull yellow."

Distribution:—Endemic.

Cœlogyne pandurata Lndl. Fol. Orch. Cœlog. (1852), 7;

Bot. Mag. t. 5084.

S. 413, Dulit ridge c. 4,000 feet altitude, September 6th, 1932, T. H. Harrison. "Small tree in moss forest. Flowers pale yellow. Pink labellum dark brown with light brown ridges."

Distribution:—Sumatra, Malay Peninsula.

Cœlogyne peltastes Rchb. f. in Gard. Chron. (1880), II.

S. 4, Marudi near sea level, July 25th, 1932, P. M. Synge. "Epiphyte c. 4 feet from the ground on dead bough. Scentless. Sepals green. Labellum green with

brown spots, frilled edge."

2657, Forest reserve Marudi under 300 m., November 1932, P. W. Richards. "Epiphyte on tree trunks near the ground, 'heath' forest. Perianth segments pale green, inside of labellum and its wings marked with dark red."

Distribution:—Endemic.

Cœlogyne exalata Ridl. in Journ. Roy. As. Soc. Str. Br. xlix (1908), 29; C. subintegra J. J. S. in Bull. Dep. Agr. Ind. neerl. xxii (1909), 12; Bull. Jard. Bot. Buit.

II. Suppl. (1930), t. 14, f. I.

S. 338, Dulit 3,000 feet altitude, August 27th, 1932, P. M. Synge. "Tree trunk c. 30 feet from the ground in primary forest. No scent. Labellum and 2 side petals and large side petal of outer whorl brownish green. Hood of post petal and column white with brown tip."

S. 339, Dulit c. 2,000 feet altitude, August 26th, 1932, P. M. Synge. "Flowers brownish orange. Column white

with brown tip."

Distribution:—Endemic.

Chelonistele kutaiensis comb. nov. Coelogyne kutaiensis J. J. S. in Bull. Jard. Bot. Buit. Ser. 3, xi (1931), 99.

S. 545, Dulit ridge c. 1250 m., September 25th, 1932, P. M. Synge. "Moss forest. Growing on the ground among moss, common. All plants coming into flower about same date. Flowers white, yellow stripe on labellum. Internal petals very pale pink. Tip of column or hood brown. Sheaths at base pale pink. Sweet scent.'

Distribution:—Endemic.

Chelonistele unguiculata sp. nov. Pseudobulbi approximati, graciliter elongato-ovoidei, 1-folii. lanceolatum ad oblongo-oblanceolatum, breviter acuminatum, acutum, crasse coriaceum, longe petiolatum. Inflorescentia folio valde juvenili synantha, laxe ad c. Bracteæ caducæ. Sepalum dorsale late oblongo-lanceolatum, obtusum. Sepala lateralia similia, Petala anguste oblongo-lanceolata, extus carinata. obtusa. Labellum usque ad medium unguiculatum, 3lobum, bicarinatum, carinis basin prope ortis super basin lobi intermedii in lamellam triangularem obtusam antice truncatam dilatatis, ungui lineari, lobis lateralicuneatis obtusissimis vel subtruncatis. intermedio obcordato marginibus undulatis apicalibus oblongis obtusis dente triangulari in sinu Gynostemii alæ e basi sensim dilatatæ. addito.

Pseudobulbs approximate, cylindric or elongate-ovoid, wrinkled, at first covered with imbricating sheaths, up to c. 5.50 cm. long, base c. .60 cm., near the apex c. .25 cm. diam. when dried, 1-leaved. Leaf lanceolate to oblong-oblanceolate, shortly acuminate, acute and pungent, keeled beneath, very thickly fleshy and coriaceous, rather abruptly narrowed to the petiole, c. 8-11.50 cm. long, 1.50-3.33 cm. wide, petiole grooved up to c. 6.50 cm. long. Inflorescence appearing from within the very young leaf, laxly up to c. 10-flowered, peduncle erect almost entirely concealed by the leaf sheaths c. 7 cm. long, rachis arched up to c. 11.50 cm. long with internodes up to c. 1.50 cm. long. Bracts caducous, not seen. Dorsal sepal broadly oblong-lanceolate, obtuse, 7-nerved, c. 1.80 cm. long, c. .65 cm. wide. Lateral sepals similar, subacute, keeled on the back, c. 1.90 cm. long, c. .65 cm. wide. Petals narrowly oblong-lanceolate, obtuse, 3-nerved, c. 1.85 cm. long, c. .37 cm. wide. Lip 3-lobed, clawed to beyond the middle, provided with 2 keels which rise just above the base and terminate abruptly above the base of the midlobe in a tall triangular obtuse lamella with truncate anterior margin, spread out c. 2.10 cm. long, c. 1.40 cm. wide across the side lobes; claw linear c. 1.10 cm. long, c. .30 cm. wide; side lobes arising beyond the middle of the lip, cuneate, apex very obtuse or subtruncate, c. .50 cm. long, c. .27 cm. wide near the apex; midlobe obcordate from a very shortly clawed (.07-.16 cm.) base, rather deeply bilobed with the lobes oblong obtuse minutely erose and a small triangular tooth in the sinus, margins undulate, c. .70 cm. long and as broad. Column nearly straight, c. 1.60 cm. tall, wings gradually dilate from the base a little constricted above the middle and ending in a triangular obtuse lobe, hood semiorbicular entire or very inconspicuously toothed, rostellum elongate narrowly triangular truncate, stigma suborbicular with the anterior margin strongly elevate. Anther ovate, beak triangular obtuse or very inconspicuously retuse.

A very distinct member of the genus by reason of the long claw of the lip the keels of which are abruptly dilate on the base of the midlobe into a tall triangular lamella and the comparatively broad petals.

S. 399 (type), Dulit ridge c. 4,000 feet altitude, September 6th, 1932, P. M. Synge. "Flowers white, yellow ridges on labellum. Sweet scent. Common in moss forest."

2420, Gunong Laiun, Sungei Balapau, Ulu Tinjar, c. 1100 m., November 2nd, 1932, *P. W. Richards*. "Epiphyte on base of trees in moss forest, very abundant. Perianth white, lobes of labellum yellow."

Described from dried plants.

Chelonistele lamellulifera sp. nov. Pseudobulbi approximati, cylindrici vel graciliter elongato-ovoidei, 1-folii. Folium oblanceolatum vel lineari-oblanceolatum, breviter acuminatum, acutum, coriaceum. Inflorescentia folio juvenili synantha, pauciflora. Bracteæ caducæ. Sepalum dorsale ellipticum obtusum. Sepala lateralia ovato-lanceolata, obtusa. Petala linearia, Labellum 3-lobum, basi breviter cuneatoobtusa. unguiculatum, lamina inter lobos laterales lamellis 2 semiorbicularibus vel crescentiformibus erectis carnosis donata, costa media elevata, lobis lateralibus falcatis triangulari-oblongis obtusis, lobo intermedio e basi breviter cuneata ovato obtuso vel minute bilobulo dente Gynostemium breve, super basin minuto in sinu. constrictum, alis sub medio subito dilatatis apici triangularibus, ala apicali leviter rotundata denticulata. approximate, cylindric or

elongate-ovoid, wrinkled, at first concealed by imbricating sheaths, up to c. 8.50 cm. long, when dry c. .75 cm. wide near the base, c. .33 cm. wide near the apex, 1-leaved. Leaf

oblanceolate or linear-oblanceolate, shortly acuminate, acute, coriaceous, keeled beneath, 17-29 cm. long, 2.30-4.80 cm. wide, gradually narrowed to the petiole, petiole grooved up to c. 8 cm. long. Inflorescence from within the young leaf. erect, few-flowered, peduncle almost entirely concealed by the leaf c. 8 cm. long, rachis subflexuous c. 6 cm. long with internodes up to c. .90 cm. long. Bracts caducous before the opening of the flower, c. 2.60 cm. long. Flowers well expanded, rather fleshy. *Dorsal sepal* elliptic, obtuse, 5-nerved, c. 1.30 cm. long, c. .58 cm. wide. *Lateral sepals* ovate-lanceolate, obtuse, a little falcate above the base, 5-nerved, c. 1.30 cm. long, c. .58 cm. wide. *Petals* linear, narrowed towards the obtuse apex, 1-nerved, c. 1.30 cm. long, c. .15 cm. wide. Lip 3-lobed, fleshy, clawed, provided between the side lobes with 2 short fleshy erect semiorbicular or crescent-shaped lamellæ, spread out c. 1.20 cm. long, c. .95 cm. wide across the side lobes; claw saccate, cuneate, c. .15 cm. long, c. .30 cm. wide at the apex; side lobes suberect, falcate, triangular-oblong, obtuse, anterior margin c. .20 cm. long; midlobe recurved, clawed for c. .15 cm., blade ovate obtuse or minutely bilobed with a minute tooth in the sinus, median nerve elevate, provided on each side with a narrow oblique groove from near the margin at the base to the apex, c. .75 cm. long and as broad. Column short, constricted above the base, abruptly and broadly dilate c. 1/3 above the base, hood short rounded denticulate, c. .54 cm. tall, c. .45 cm. wide in the middle, stigma large ovate with elevate margins, rostellum short triangular.

This curious and very distinct species is well characterized by the saccate claw of the lip which bears 2 short lamellæ in place of the usual keels, and the short column.

S. 531 (type), Dulit ridge c. 1250 m., September 19th, 1932, P. M. Synge. "Growing on bank in moss forest. Flowers with pale green petals. Brown markings on centre and on labellum. Stem surrounded by pale green sheaths. Sweet scent."

S. 423, Dulit ridge c. 4,000 feet altitude, September 6th, 1932, *P. M. Synge*. "Moss forest, common. Flowers green, brown tip to column. Slight sweet smell."

Described from dried plants.

Chelonistele Richardsii sp. nov. Pseudobulbi parvi, ovoidei, bifolii. Folia elliptica vel oblongo-elliptica, acuta, crasse carnosa, basi petiolata. Inflorescentia foliis valde juvenilibus synantha, rachide nutante pauciflora. Bracteæ caducæ. Sepalum dorsale oblongo-obovatum, obtusum. Sepala lateralia falcata, oblongo-ovata,

lanceolata. subacuta. Petala anguste acuminata. Labellum unguiculatum, 3-lobum, anguste obtusa. ungui oblongo concavo, super unguem carinis 2 valde abrupte elevatis medio unguicis lobi intermedii evanescentibus basi in lobulum brevem extrorsum productis, lobis lateralibus minimis falcate triangularibus subacutis, lobo intermedio unguiculato ungui oblongo apicem cuneato-dilatato lamina abrupte latissime apici biloba. ovata Gynostemium tubercula parva donatum; alis in 1/3 parte inferiore valde dilatatis triangularibus obtusis apici incurvis. ala apicali vix rotundata denticulata.

Pseudobulbs c. 1 cm. distant, ovoid, wrinkled, forming an acute angle with the rhizome, rather concave beneath, c. 2 cm. long, c. .60 cm. wide, 2-leaved. Leaves elliptic or oblong-elliptic, acute, margins a little recurved, thickly fleshy, grooved above, keeled beneath, c. 4 cm. long, c. 1.40 cm. wide, petiole grooved c. 1.70 cm. long. Inflorescence from between the very young leaves, peduncle nude c. 6 cm. rachis nodding laxly c. 9-flowered c. 7.50 cm. long with internodes up to c. 1 cm. long. Bracts caducous, not seen. Dorsal sepal oblong-obovate, obtuse, 5-nerved, c. .87 cm. long, c. .47 cm. wide. Lateral sepals falcate, oblong-ovate, subacute, 5-nerved, c. .90 cm, long, c. .40 cm. Petals narrowly lanceolate, acuminate, narrowly obtuse, 3-nerved, c. .77 cm. long, c. .15 cm. wide. Lip shortly clawed, 3-lobed, blade provided between the side lobes with 2 short keels which reach to about the middle of the claw of the midlobe and are produced at the abruptly elevate base to a short rounded extrorse lobe, spread out including the claw c. 1.30 cm. long, c. .83 cm. wide across the blade of the midlobe; claw oblong, concave, minutely papillose, c. .20 cm. long; side lobes erect, tooth-like, falcate, triangular, subacute, hardly .10 cm. long; midlobe provided at the base with an oblong claw which is cuneately dilate in the upper half, blade abruptly dilate very broadly ovate or obreniform deeply bilobed with the lobes acutely divergent broadly cuneate with gently rounded apex, c. .90 cm. long, c. .83 cm. wide. Column c. .50 cm. tall, provided at the base with a small conic tubercle, wings dilate from below the middle roundly triangular obtuse incurved over the face of the column, hood gently rounded denticulate, rostellum oblong obtuse, stigma suborbicular with strongly elevate margins.

Another very distinct species readily distinguished by the 2 short fleshy leaves, the small flowers, the keels of the lip produced at the base to a short auricle and the tubercle at the base of the column. S. 59, Dulit ridge, August 1st, 1932, P. W. Richards. "Moss forest, odourless. Flowers greenish yellow, brown fringe to labellum, yellow lines on stigma."

Described from a single dried plant and a flower

preserved in spirit.

Pholidota ventricosa Rchb. f. in Bonpl. v (1857), 43.

2422, Gunong Laiun, Sungei Balapau, Ulu Tinjar c. 900-1000 m., November 2nd, 1932, P. W. Richards. "Fallen log in rain forest on ridge. Perianth greenish yellow."

Distribution:—Sumatra, Java, Philippines.

Pholidota carnea Lndl. Gen. & Sp. Orch. (1830), 37.

S. 440, Dulit ridge c. 1230 m., September 7th, 1932, P. M. Synge. "Small tree in moss forest. Flowers pale pink, tip of column brown."

S. 443, Dulit ridge c. 4,000 feet altitude, September 7th, 1932, native collector. "Transitional moss-rain forest.

Flowers very pale pink, tip of labellum brown."

S. 460, Dulit ridge c. 1240 m., September 10th, 1932, P. M. Synge. "Moss forest. Flowers small pale pink. No scent. Rather common.

Distribution:—Sumatra, Java, Malay Peninsula,

Philippines.

Pholidota gibbosa De Vr. Ill. Orch. (1854), t. v, f. 1; t. xi, f. 62.

S. 549, Dulit ridge c. 1200 m., October 3rd, 1932, P. W. Richards. "Moss forest growing on tree. Labellum and hood pale shell pink fading to cream on ledge of labellum. Tip of column brown. No scent."

Distribution:—Sumatra, Java, Malay Peninsula.

Dendrochilum brevilabratum Pfitz. in Engl. Pflanzenr. xxxii (1907), 89: *Platyclinis brevilabrata* Rendle in Journ. Bot. xxxix (1901), 173.

S. 100, Dulit c. 250 feet above camp, August 5th, 1932, native collector. "Pseudobulbs yellowish. Flowers white,

scentless."

S. 175, Dulit under 300 m., August 11th, 1932, native collector. "Flowers small, white, scentless."

Distribution:—Endemic.

Dendrochilum longirachis Ames Orch. vi (1920), 60.

S. 483, Ulu Koyan c. 1200 m., September 15th, 1932, P. W. Richards. "Sand forest. Tree trunk near ground. Flower very pale green, brown stripes on labellum. Slight sweet scent."

Distribution:—Endemic.

Dendrochilum (§ Platyclinis) gracilipes sp. nov. Pseudobulbi gracillime cylindrici, 1-folii. Folium lanceolatum vel oblanceolatum, obtusum. Inflorescentia elongata,

multiflora. Bracteæ ovatæ, obtusæ. Sepalum dorsale lanceolatum, subacutum. Sepala lateralia basi subfalcata, anguste ovato-lanceolata, acuminata, subacuta. Petala anguste oblongo-lanceolata, breviter acuminata. Labellum valde inconspicue 3-lobum, inter lobos laterales carinis 2 basi conjunctis donatum nerva media breviter elevata, lobis lateralibus vix distinctis, marginibus erosulis, lobo intermedio ovato obtuso marginibus minute erosulis. Gynostemii stelidia sub medio orta. linearia. subacuta. ala apicali integra acuminata subacuta.

Pseudobulbs approximate to 2 cm. distant, elongate, very slender, cylindric, at first covered in the lower 1/9 with c. 5 tubular membraneous sheaths, up to c. 15.50 cm. long, when dried c. .30 cm. diam. near the base .18 cm. diam. near the apex, 1-leaved. Leaf lanceolate or oblanceolate, obtuse, thinly coriaceous with c. 7 strong nerves, up to c. 20 cm. long, c. 3 cm. wide, petiole grooved up to c. 3 cm. long. Inflorescence elongate, erect, very many-flowered. peduncle rather stout terete provided with a sterile appressed bract-like sheath below the rachis c. 14 cm. long. rachis c. 25 cm. long with internodes up to .60 cm. long. Bracts ovate, obtuse, 5-nerved, c. .35 cm. long, c. .25 cm. wide. Dorsal sepal lanceolate, subacute, 3-nerved, c. .65 cm. long, c. .17 cm. wide. Lateral sepals subfalcate at the base, narrowly ovate-lanceolate, acuminate, subacute, 3nerved, c. .65 cm. long, c. .20 cm. wide. Petals narrowly oblong-lanceolate, shortly acuminate, acute, 3-nerved, c. .65 cm. long, c. .15 cm. wide. Lip recurved above the base, very inconspicuously 3-lobed, provided between the side lobes with 2 short tall keels which are joined at the base and a little introrse in the upper $\frac{1}{2}$ reaching to above the base of the midlobe, median nerve shortly elevate, spread out c. .50-.57 cm. long, c. .33 cm. wide across the midlobe; side lobes very obscure with margins minutely erose; midlobe ovate, obtuse, margins minutely erose sometimes papillose or minutely ciliolate, c. .35-.40 cm. long, c. .35 cm. wide. Column c. .30-.33 cm. tall, stelidia from a little below the middle linear subacute nearly as long as the hood, hood entire oblong acuminate subacute.

This plant is well characterized by the elongate very

slender stem-like pseudobulbs.

S. 405, Dulit ridge c. 4,000 feet altitude, September 5th, 1932, T. H. Harrison. "Moss forest. Flowers cream.

Slight scent."

S. 418 (type), Dulit ridge c. 4,300 feet altitude, September 6th, 1932, *P. M. Synge*. "Moss forest. Flowers pale green, tip of column white. Stalks of leaves pinkish."

- S. 482, Ulu Koyan c. 1200 m., September 15th, 1932, P. W. Richards. "Flowers pale green."
- S. 512, Dulit ridge c. 950 m., September 17th, 1932, C. H. Hartley. "Flowers pale green. No scent."

 Described from dried plants.

Dendrochilum (§ Platyclinis) Dewindtianum W. W. Sm. var. sarawakense var. nov. Pseudobulbi approximati vel subapproximati, ovoidei, 1-folii. Folium lineare, apici acutum vel subobtusum conduplicatum, petiolo brevi. Inflorescentia folio juvenili synantha, laxe c. 10-flora. Bracteæ ovatæ, obtusæ. Sepala dorso carinata, lanceolata, breviter acuminata, acuta. oblongo-lanceolata, breviter acuminata, acuta. lum 3-lobum, intus carinis 2 basi conjunctis apicem labelli prope evanescentibus interdum basi utrinque in dentem minimum productis, nerva media elevata, lobis lateralibus usque ad medium labelli attingentibus parte libera brevi subulata marginibus erosulis, lobo intermedio obovato obtuso marginibus apicem versus erosulis. Gynostemii stelidia sub medio orta, usque ad rostellum attingentia, ala apicali rotundatim triangulari subacuta integra.

Pseudobulbs approximate to .50 cm. distant, ovoid, wrinkled, at first covered with tubular membraneous sheaths which break up to fibres, c. 2 cm. long, c. .60 cm. diam., 1-leaved. Leaf linear, apex conduplicate acute or subobtuse, thinly coriaceous, often with margins more or less recurved when dry, c. 5.90 cm. long, c. .60 cm. wide, petiole grooved c. 2 cm. long. Inflorescence appearing from within the young folded leaf, erect, lax, c. 10-flowered, peduncle provided with c. 2 bract-like sheaths c. 3.50 cm. long, rachis c. 4.50 cm. long with internodes up to .50 cm. long. Bracts ovate, obtuse, 3-nerved, c. .30 cm. long, c. .24 cm. wide. Sepals keeled on the back, the laterals conspicuously so, lanceolate, shortly acuminate, acute, the laterals subfalcate, 3-nerved, c. .60 cm. long, the dorsal c. .18 cm. the laterals c. .22 cm. wide. Petals oblong-lanceolate, shortly acuminate, acute, sometimes inconspicuously clawed at the base, 3-nerved, c. .57 cm. long, c. .18 cm. wide. Lip 3-lobed, blade provided with 2 keels which reach almost to the apex of the lip and are joined at the base by a short transverse ridge which sometimes bears a minute extrorse tooth on each side, median nerve elevate for the whole length, spread out c. .50 cm. long, .20-.30 cm. wide across the midlobe; side lobes reaching to about the middle of the lip or a little beyond, the free part short subulate, posterior margin minutely erose below the apex; midlobe obovate obtuse,

margins minutely erose towards the apex, c. .26 cm. long, .20-.30 cm. wide. *Column* .33-.38 cm. tall, stelidia arising from below the middle and reaching to the rostellum, hood entire roundly triangular subacute of obtuse. *Column foot* distinct, minute.

The variety here described differs from the species

principally in the more slender habit.

S. 186, Dulit c. 700 m., August 13th, 1932, E. Shackleton. "Tree trunk among moss. Slightly sweet scent. Flowers greenish yellow, labellum green at the base with brown patch on end. Pseudobulbs yellowish."

S. 558, Dulit ridge c. 1300 m., October 7th, 1932, native collector. "Moss forest growing on small tree. Flowers

green. No scent."

Described from dried plants.

Dendrochilum (§ Platyclinis) dulitense sp. nov. Pseudobulbi approximati, minimi, ovoidei vel subglobosi, lineare. obtusum. 1-folii. Folium Inflorescentia gracilis. Bracteæ laxe c. 6-flora. oblongo-ovatæ. brevissime acuminatæ, acutæ. Sepala ovato-lanceolata, acuta. Petala anguste ovata, longe acuminata, acuta. Labellum 3-lobum, intus ad basin carinis brevibus 2 basi conjunctis donatum, nerva media breviter elevata. lateralibus retrorsim triangularibus margine antico erosulis, lobo intermedio transverse elliptico Gynostemii stelidia super basin orta, obtusissimo. brevia, cuneata, apici vix rotundata vel subtruncata, vix usque ad medium attingentia, ala apicali rotundata integra.

Pseudobulbs approximate, very small, ovoid or subglobose, minutely wrinkled, up to c. .50 cm. tall, c. .30 cm. diam., 1-leaved. Leaf linear, obtuse, coriaceous, margins often revolute in the dried plant, c. 2 cm. long, c. .20 cm. wide, petiole grooved c. .25 cm. long. Inflorescence from within the unexpanded leaf, erect or nodding, slender, laxly c. 6-flowered, peduncle nude c. 1.70 cm. long, rachis c. 2.50 Bracts oblong-ovate, very shortly acuminate, acute, 3-nerved, c. .18 cm. long. Sepals ovate-lanceolate, acute, 3-nerved, c. .50 cm. long, c. .15 cm. wide, the laterals subfalcate acuminate c. .18 cm. wide. Petals narrowly ovate, long acuminate, acute, 1-nerved, c. .47 cm. long, c. .13 cm. wide. Lip 3-lobed, 3-nerved, the blade provided inside at the base with 2 short keels which are joined at the base by a short transverse ridge, median nerve elevate to base of midlobe, spread out c. .43 cm. long, c. .37 cm. wide across the midlobe; side lobes retrorse, triangular, subacute, reaching to c. the middle of the lip, the anterior

margin minutely erose; midlobe transversely elliptic, very obtuse, broader than long. Column arched, c. .28 cm. tall, stelidia arising just above the base short cuneate apex scarcely rounded or subtruncate, reaching about to the middle, hood short entire roundly triangular obtuse, rostellum large porrect ovate, stigma transversely oblong elevate along the anterior margin.

A minute plant with comparatively large flowers and

a characteristic lip.

S. 435, Dulit ridge c. 1230 m., September 7th, 1932, P. M. Synge. "Small tree in moss forest. Petals pink, labellum pale yellow. Stalk pale pink."

Described from dried material.

Dendrochilum (§ Platyclinis) integrilabium sp. nov. Pseudobulbi ad c. .30 cm. dissiti, fusiformes, 1-folii. Folium angustissime lineare, apicem versus leviter dilatatum, obtusum, minute apiculatum. Inflorescentia e folio fere maturo, erecta, gracillima, dimidio superiore multiflora. Bracteæ ellipticæ. Sepalum dorsale oblongo-lanceolatum, acutum. Sepala lateralia ovato-lanceolata, acuta, falcata. Petala linearia, acuta, medio fere leviter dilatata. Labellum integrum, explanatum oblongo-ellipticum, obtusum, intus super basin carinis conspicuis 2 ¼ sub apice attingentibus basi conjunctis. Gynostemii stelidia basalia, gynostemio vix æquilonga, linearia, acuta, ala apicali rotundatim triangulari obtuso.

Pseudobulbs up to c. .30 cm. distant, at first concealed membraneous tubular sheaths, fusiform, minutely wrinkled, forming an acute angle with the rhizome, up to c. 1.50 cm. long, c. .25 cm. diam., 1-leaved. Leaf narrowly linear, a little dilate upwards, apex obtuse minutely apiculate, rather thin in texture with the median nerve elevate beneath, up to c. 6.70 cm. long, c. .28 cm. wide, petiole grooved very slender c. .65 cm. long. Inflorescence appearing with the nearly mature leaf, erect, very slender, many-flowered, peduncle provided beneath the rachis with 1-2 empty bract-like sheaths up to c. 6 cm. long c. .03 cm. diam., rachis c. 6 cm. long. Bracts elliptic, shortly acuminate, acute, 1-nerved, c. .13 cm. long. Dorsal sepal oblong-lanceolate, acute, 1-nerved, c. .23 cm. long, c. .07 cm. Lateral sepals ovate-lanceolate, acute, falcate, 1-nerved, c. .23 cm. long, c. .08 cm. wide. Petals linear. acute, a little dilate about the middle, 1-nerved, c. .20 cm. long, c. .03 cm. wide. Lip entire, provided inside above the base with 2 conspicuous keels which reach to about 1/4 below the apex and are joined at the base by a transverse ridge, recurved above the base, when spread out oblong-elliptic, apex fleshy obtuse, c. .13 cm. long, c. .04 cm. wide. *Column* c. .12 cm. tall, stelidia arising from the base and reaching nearly to the apex linear acute, hood roundly triangular entire, rostellum large triangular subacute, stigma suborbicular with the anterior margin elevate.

A small-flowered species characterized by the very small entire lip recalling that of section *Eudendrochilum*.

S. 484, Ulu Koyan c. 1200 m., September 15th, 1932, P. W. Richards. "Tree trunk c. 2 m. from the ground in sandy forest. Flowers very pale green."

Described from dried plants.

Dendrochilum exasperatum Ames Orch. vi (1920), 50.

S. 436, Dulit ridge c. 1230 m., September 6th, 1932, P. M. Synge. "Small tree in moss forest. Flowers pale brown. No scent."

Distribution:—Endemic.

Dendrochilum (§ Platyclinis) sublobatum sp. nov. Pseuapproximati, cylindrici, 1-folii. Folium angustissime lineari-oblanceolatum, obtusum, minute apiculatum. Inflorescentia ex apice pseudobulbi maturi, elongata, multiflora. Bracteæ ovatæ, acutæ. Sepalum dorsale lanceolatum, acutum. Sepala lateralia oblongoovata, subacuta, falcata. Petala oblanceolata, acuta, Labellum breviter unguiculatum, lamina falcata. dimidio inferiore subquadrata lateribus leviter incisis, dimidio superiore triangulari acuminata acuta basi carina hippocrepidiformi donata. Gynostemii stelidia basalia, linearia, obtusa, usque ad antheram attingentia,

ala apicali triangulari obtusissima.

Pseudobulbs approximate, cylindric, wrinkled, at first covered with membraneous sheaths, 1-leaved. Leaf very narrowly linear-oblanceolate, obtuse, minutely apiculate, thinly corraceous with c. 3 strong nerves, 9-16 cm. long, .30-50 cm. wide, base narrowed gradually to a grooved petiole 1-2.80 cm. long. Inflorescence from the apex of the mature pseudobulb, longer than the leaf, erect, manyflowered, peduncle nude 1.20-5 cm. long c. .07 cm. diam., rachis up to 17.50 cm. long with internodes up to c. .30 cm. long. *Bracts* ovate, acute, 1-nerved, c. .10 cm. long or 1/3 shorter than pedicel and ovary. Dorsal sepal lanceolate, acute, 3-nerved, c. .25 cm. long, c. .09 cm. wide. Lateral sepals oblong-ovate, subacute, falcate, 3-nerved, c. .20 cm. long, c. .10 cm. wide. *Petals* oblanceolate, acute, falcate, 1-3-nerved, c. .22 cm. long, c. .06 cm. wide. *Lip* shortly clawed, blade inconspicuously 5-lobed subquadrate in the lower ½ with sides a little narrowed about the middle triangular acuminate acute in the upper 1/2, provided at the base with a conspicuous horse-shoe keel, spread out c. .15 cm. long, c. .09 cm. wide. Column c. .15 cm. tall, stelidia basal linear obtuse reaching to the anther, hood entire triangular very obtuse, rostellum large broadly rounded.

A small species of the affinity of *D. dolichobrachium* (Schltr.) Ames, *D. Gibbsiae* Rolfe and *D. Haslamii* Ames. From all of these it differs in the smaller flowers with much less conspicuously lobed lip and much shorter stelidia.

S. 406 (type), Dulit ridge c. 4300 feet altitude, September 5th, 1932, P. M. Synge. "Small trees in moss forest. Flowers small, greenish yellow, tip of column brown. Very slight sweet scent."

2290, Dulit c. 1230 m., October 18th, 1932, J. Ford. "Moss forest. Flowers greenish yellow."

Described from dried plants.

Dendrochilum (§ Platyclinis) anomalum sp. nov. Pseudobulbi ovoidei, 1-folii. Folium oblongo-ellipticum, breviter obtuse apiculatum, basi in petiolum brevem abrupte angustatum. Inflorescentia folio inexplanato synantha, elongata, dimidio superiore multiflora. Bracteæ late ovatæ, subacutæ. Sepalum dorsale anguste oblongum, acutum. Sepala lateralia oblongo-lanceolata, breviter acuminata, acuta. Petala anguste oblongooblanceolata, acuta. Labellum 3-lobum, lamina inter lobos laterales carina V-formiter donata carina paullo longiore apicem versus leviter dilatata utrinque addita; lobi laterales triangulares, subacuti, margine postico erecto sub apice rotundatim dilatato, apicem versus recurvi et transverse plicati; lobus intermedius valde recurvus, ovatus, subacutus, inconspicue tricarinatus. Gynostemium elongatum, papillosum, stelidiis stigmate ortis anguste triangularibus acutis falcatis. ala apicali super basin triangularem transverse oblonga apici truncata et erosula.

Pseudobulbs approximate to .70 cm. distant, ovoid, wrinkled, at first covered with rather fleshy imbricating sheaths, c. 2.30 cm. long, c. .75 cm. diam. in the dried plant, 1-leaved. Leaf oblong-elliptic, shortly obtusely apiculate, thinly coriaceous with c. 9 strong nerves, margins a little recurved, c. 9.33 cm. long, c. 3.33 cm. wide, the base rather abruptly narrowed to a grooved petiole c. 1.75 cm. long. Inflorescence from within the unexpanded leaf, elongate, many-flowered, peduncle terete rather stout provided below the rachis with some imbricating bract-like appressed sheaths c. 16 cm. long c. .10 cm. diam., rachis c. 17.50 cm. long with internodes c. .40 cm. long. Bracts greatly

exceeding the pedicel and ovary, broadly ovate, subacute, c. .55 cm. long. c. .48 cm. wide. *Dorsal sepal* narrowly oblong, acute, 3-nerved, c. .63 cm. long, c. .18 cm. wide. Lateral sepals oblong-lanceolate, shortly acuminate, acute, inconspicuously sigmoidly curved, 3-nerved, c. .68 cm. long. c. .21 cm. wide. Petals narrowly oblong-oblanceolate, acute, subfalcate, 3-nerved, c. .60 cm. long, c. .12 cm. wide. anomalous and recalling that of a Coelogune, 3-lobed from the middle, the blade between the side lobes provided with a V-shaped keel from above the base to c. 1/4 below the base of the midlobe, a thinner little longer keel dilate towards the apex on each side, the blade parallel to the column, minutely papillose beneath, spread out c. .60 cm. long, c. .30 cm. wide across the side lobes; side lobes triangular, subacute, margins minutely papillose towards the apex, posterior margin erect roundly dilate below the apex, recurved towards the apex with a short transverse fold; midlobe abruptly and strongly recurved, ovate, subacute, fleshy, minutely transversely wrinkled, provided with 3 inconspicuous broad rounded keels from the base to below the apex, very minutely papillose above and beneath, margins minutely erose, c. .30 cm. long and as broad. Column papillose, c. .42 cm. long, stelidia arising from below the stigma short narrowly triangular falcate papillose c. .07 cm. long, hood transversely oblong above the triangular base apex truncate and minutely erose, stigma transversely oblong anterior margin elevate. Column foot papillose, c. .06 cm. long. Ovary warty, c. .17 cm. long, pedicel c. .20 cm. long.

This very distinct species appears to have no near allies in the genus. The curious lip structure, much more resembling a *Coelogyne* and the tall papillose column with short curved stelidia arising from just below the stigma are very characteristic features.

2497, Ulu Koyan c. 800-1000 m., November 7th, 1932, native collector. "Heath forest. Outer perianth segments dull orange-yellow, labellum orange, central parts red."

Described from a dried plant and flowers preserved in spirit.

Dendrochilum bigibbosum J. J. S. in Bull. Dep. Agr. Ind. neerl. xlv (1911), 13; Bull. Jard. Bot. Buit. II. Suppl. (1930), t. 16, f. 1.

S. 156, Dulit c. 300 m., August 10th 1932, *Mc Leod*. "Fallen tree near crown. Flowers greenish orange, labellum orange-brown and green at base. Column yellow. No scent."

Distribution:—Endemic.

Dendrochilum (§ Platyclinis) hologyne sp. nov. dobulbi ad c. 2.75 cm. dissiti, anguste cylindrici, 1-folii. Folium anguste lineari-oblanceolatum, acutum. Inflorescentia elongata, gracillima, apicem versus dense multiflora. Bracteæ late triangulari-ovatæ. Sepalum dorsale oblongo-lanceolatum, anguste obtusum. Sepala oblongo-ovata, obtusa. Petala oblonga, acuminata, acuta, Labellum integrum, concavum, triangulari-ovatum vel oblique subquadratum, obtusum, intus dimidio inferiore carinis 3 donatum, carina intermedia parva tuberculiformi, carinis exterioribus divaricatis dimidio superiore incurvis et valde dilatatis. Gynostemium exalatum, rostello suberecto triangulari.

Rhizome long-creeping, emitting 2-3 roots from each node, c. .20 cm. diam,, internodes up to c. .70 cm. long. Pseudobulbs up to c. 2.75 cm. distant, narrowly cylindric, wrinkled, at first covered by tubular imbricating membraneous sheaths, up to c. 10.75 cm. long, c. .25 cm. diam. when dried, 1-leaved. Leaf narrowly linear-lanceolate, acute, thinly coriaceous, keeled beneath, up to c. 23 cm. long, c. .85 cm. wide, base rather abruptly narrowed to a grooved petiole c. 1.80 cm. long. *Inflorescence* from the apex of the almost mature pseudobulb, elongate, very slender, as long as the leaves or longer, peduncle filiform provided beneath the rachis with some appressed imbricating bract-like sheaths c. 16 cm. long c. .05 cm. diam., rachis thickened more or less 4-sided and concave alternately on each side above the flower c. 8 cm. long with internodes c. .20 cm. long. *Bracts* much longer than the pedicel and ovary, broadly triangular-ovate, obtuse, c. .27 cm. long, c. .32 cm. wide. Dorsal sepal oblong-lanceolate, narrowly obtuse, 3-nerved, c. .20 cm. long, c. .09 cm. wide. Lateral sepals oblong-ovate, obtuse, falcate, 3-nerved, keeled on the back towards the apex, c. .25 cm. long, c. .11 cm. wide. *Petals* oblong, acuminate, acute, 1-nerved, c. .22 cm. long, c. .05 cm. wide. Lip entire, concave with erect margins, triangular-ovate or obliquely subquadrate, obtuse, 3-nerved, provided inside in the lower ½ above the base with 3 rounded keels, the median keel short tuberculiform, the outer keels divaricate from the base almost rightangularly incurved and much dilate in the upper ½ with the apex nearly contiguous reaching a little beyond the middle of the lip, spread out c. .20 cm. long and as broad. Column entire, c. .10 cm. tall, rostellum suberect triangular, stigma semiorbicular.

The nearest affinities of this plant appear to be D. fuscescens Schltr. & J. J. S. and D. lamellatum J. J. S.

from Sumatra from both of which it differs in the much smaller flowers with a very different lip.

S. 513 (type), Dulit ridge c. 1400 m., September 17th, 1932, P. M. Synge. "Growing in moss on top of peak in moderate sun. Flowers pale brown, column slightly darker than petals. No scent."

S. 415, Dulit ridge c. 4000 feet altitude, September 6th, 1932, *P. M. Synge*. "Moss forest. Flowers small, greenish. Leaves medium green." In this plant the flowers are more or less appressed to the rachis.

Described from dried plants.

Dendrochilum (§ Platyclinis) minimiflorum sp. nov. Pseudobulbi ovoidei, 1-folii. Folium angustissime lineari-oblanceolatum, acutum, tenuiter coriaceum. Inflorescentia apicem versus multiflora. Bracteæ late ovatæ vel suborbiculares, obtusæ. Sepala oblongoovata, breviter abrupteque acuminata, acuta. late ovata, obtusa. Labellum integrum, concavum, e basi cuneata late ovatum. apici incrassatum apiculatum, intus super basin carina hippocrepidiformi basi bidenticulata donatum. Gynostemium breve, crassum, stelidiis stigma prope ortis brevibus triangularibus obtusis.

Rhizome creeping, branched. Pseudobulbs up to c. .50 cm. distant, ovoid, wrinkled, sometimes a little curved, c. .90 cm. long, c. .50 cm. diam. near the base, 1-leaved. Leaf very narrowly linear-oblanceolate, acute, thinly coriaceous, margins more or less revolute in the dried plant, 5.20-7.50 cm. long, c. .20 cm. wide, base narrowed gradually to a petiole .50-1.50 cm. long, the petiole very slender grooved. Inflorescence from the apex of the immature pseudobulb, much longer than the leaf, many-flowered, peduncle filiform provided beneath the rachis with an appressed bract-like sheath up to c. 8.50 cm. long, c. .05 cm. diam., rachis c. 5 cm. long with internodes c. .15 cm. long. Bracts longer than the pedicel and ovary, broadly ovate or suborbicular, obtuse, margins erose-crenate, c. .10 cm. long, c. .08 cm. wide. Dorsal sepal oblong-ovate, abruptly and shortly acuminate, acute, 3-nerved, c. .15 cm. long, c. .09 cm. wide. Lateral sepals oblong-ovate, very shortly acuminate, acute or obtuse, 1-nerved, c. .13 cm. long, c. .08 cm. wide. *Petals* broadly ovate, obtuse, falcate, 1-nerved, c. .13 cm. long, c. .08 cm. Lip entire, concave, fleshy, broadly ovate from a cuneate base, very fleshy and acutely apiculate at the apex, provided inside above the base with a prominent horse-shoe apparently red keel with 2 minute teeth at the base, spread out c. .07 cm. long, c. .05 cm. wide. Column short, stout,

c. .04 cm. tall, stelidia rising from near the stigma short

triangular obtuse.

This very interesting plant is characterized by the very small dimensions of the flowers and by the structure of lip and column. It is the smallest flowered species of the sub-genus known to me.

S. 476 (type), Dulit ridge c. 1300 m., September 13th, 1932, P. W. Richards. "Small tree in moss forest. Flowers small pale green with brown centre. Pseudobulbs wrinkled,

chestnut brown. Slight scent."

S. 446, Dulit ridge c. 1230 m., September 7th 1932, P. M. Synge. "Moss forest. Flowers pale green, chestnut column. Pseudobulb chestnut. Slight sweet scent."

S. 548, Dulit ridge c. 1000 m., October 1st, 1932, P. W. Richards. "Flowers small, pale brown, darker brown tip to column. No scent. Stem brown. Pseudobulbs chestnut brown."

Described from dried plants.

Claderia viridiflora Hook. f. Fl. Brit. Ind. v (1890), 810; Ic. Pl. xxi (1892), t. 2083.

S. 16, Marudi near sea level, July 25th, 1932, P. M. Synge. "Flowers greenish."

Distribution:—Sumatra, Malay Peninsula.

Dilochia gracilis comb. nov. Arundina gracilis A. & S. Orch. vi (1920), 96.

S. 534, Dulit ridge c. 1350 m., September 20th 1932, P. M. Synge. "Growing in rather dry moss forest on top of subsidiary peak. Flower white with pale crimson markings outside. Column crimson at base. Labellum white inside, pale yellow near tip. Slight sweet scent. Stem crimson-brown."

Fruiting specimens found by me on Mount Kinabalu in British North Borneo have convinced me that this plant is a true *Dilochia*. It agrees also in habit. *Distribution*:—Endemic.

Oberonia ciliolata Hook, f. Fl. Brit, Ind. vi (1890), 181; Ic. Pl: t. 2318.

S. 447, Dulit ridge c. 1240 m., September 7th, 1932, native collector. "Flowers pale orange-brown with orange centre."

Distribution:—Malay Peninsula.

*Oberonia insectifera Hook. f. Ic. Pl. t. 2004.

. S. 319, Dulit c. 300 m., August 23rd 1932, P. M. Synge. "Flowers brown, small. Leaves tinged pink at the base."

Distribution:—Malay Peninsula.

*Microstylis Blumei Borl. & J. J. S. Ic. Bog. II, t. cviii. B.

S. 136, Dulit c. 500 m., August 8th, 1932, *P. M. Synge*. On a dead log in shade in rain forest. Flowers purple lake, column green. Stalk of flower purple lake."

S. 165, Dulit under 300 m., August 11th, 1932, native

collector. "Flowers purple lake."

S. 359, Dulit under 300 m., August 30th 1932, native collector. "Epiphytic in primary forest. Flowers crimson lake. No scent."

Distribution:—Java.

Microstylis commelinifolia Zoll. & Mor. in Nat. en Geneesk. Arch. Neerl. Ind. 1 (1844), 402.

S. 477, Dulit ridge c. 1300 m., September 13th, 1932, P. M. Synge. "Growing on limestone cliff facing South. Flowers small, pale greenish yelow, stem purplish. Leaves pale green."

 $\overline{D}istribution:$ —Java.

Microstylis Andersonii Ridl. in Kew Bull. 1914, 210.

S. 599, Niah under 300 m., November 1932, *P. M. Synge*. "Shade on damp limestone crags. Flower stalk purple. Petals purple, labellum and stigma yellow. The leaves have a pale green stripe in the centre bordered by broad purplish brown stripes."

Distribution:—Endemic.

Microstylis latifolia J. J. S. in Fl. Buit. vi (1905), 248; Atlas f. clxxxc: M. congesta Rchb. f. in Walp. Ann. vi (1861), 206.

S. 46, Marudi near sea level, July 27th, 1932,

P. M. Synge. "Flowers brownish in colour."

Distribution:—Sumatra, Java, Malay Peninsula, Celebes, N. Guinea, Australia, Philippines, Cochin China, China, India and Ceylon.

Liparis parviflora Lndl. Gen. & Sp. Orch. (1830), 31.

S. 238, Dulit under 300 m., August 18th, 1932, P. M. Synge. "Labellum pink, petals white. Scentless."

Distribution:—Sumatra, Java, Malay Peninsula, Philip-

pines, Celebes, Siam.

Liparis confusa J. J. S. Fl. Buit. vi Orch. (1905), 275, Atlas n. cexi.

S. 578, Niah under 300 m., November 1932, P. M. Synge, "Petals greenish yellow, labellum red. No scent."

Distribution:—Java, ? Sumatra.

Liparis longissima J. J. S. in Bull. Jard. Bot. Buit. Ser. 2. xiii (1914), 6; l.c. II. Suppl. t. 25, f. vi.

S. 234, Dulit under 300 m., August 17th, 1932, P. M. Synge. "Small tree trunk c. 3 feet from the ground,

Gardens Bulletin, S.S.

moderately common. Flowers white, small. Lip touched with pale pink. No smell."

Distribution:—Endemic.

*Liparis purpureo-viridis Burk. & Holt. in Gard. Bull. Str.

Settle. iii (1923), 77.

S. 532, Dulit ridge c. 1350 m., September 19th, 1932, *P. W. Richards.* "Moss forest. Growing among moss near bottom of small rocky face, shady and damp. Labellum green with prominent purplish veins. Two lateral filaments recurved downwards, purple. Stem purple. Leaf glistening purple, bluish green beneath." A sketch in colour shows the sepals green, the petals purple and the lip green with purple nerves and fimbriæ.

Distribution:—Malay Peninsula.

Agrostophyllum majus Hook. f. Fl. Brit. Ind. v (1890), 824; Ic. Pl. xxi (1892), t. 2096.

S. 591, Niah under 300 m., November 1932, P. M. Synge. "Flowers small, white. Slight sweet scent."

Distribution:—Sumatra. Malay Peninsula.

Distribution:—Sumatra, Malay Peninsula.

*Agrostophyllum confusum J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. II (1920), 38; II. Suppl. (1930), t. 31, f. 1.

S. 81, Dulit c. 1800 feet above camp, August 4th, 1932, native collector. "Flowers white."

Distribution:—Sumatra, Malay Peninsula.

Agrostophyllum bicuspidatum J. J. S. in Ic. Bog. II. (1903), 55.

S. 176, Dulit under 300 m., August 12th 1932, native collector. "Flowers white, scentless."

Distribution:—Java, Sumatra, Malay Peninsula.

Ceratostylis alata sp. nov. Caules approximati, 3-nodii, 1-folii. Folium anguste lineari-oblanceolatum, breviter inæqualiter bilobum. Inflorescentiæ apicales, fasciculatæ, breves, unifloræ. Sepala extus longe pilosa. Sepalum dorsale oblongum, obtusum. Sepala lateralia e basi falcata oblongo-oblanceolata, obtusa. Petala elliptico-lanceolata, acuminata, acuta. Labellum e basi angusta late spathulatum, crasse conico-apiculatum apiculo piloso, intus in 2/3 partibus inferioribus bicarinatum. Gynostemium breve, lateribus alte alatum.

Stems approximate, terete, internodes 3, c. 2.80 cm. long, 1-leaved. Leaf very narrowly linear-oblanceolate, shortly unequally bilobed or oblique, coriaceous, c. 9 cm. long, c. .30 cm. wide, petiole grooved up to c. 1.30 cm. long. Inflorescences from the apex of the stem, fascicled, 1-flowered, peduncle densely white-hairy c. .80 cm. long.

Bract minute, ovate, acute. Sepals long-hairy outside. Dorsal sepal oblong, obtuse, 3-nerved, c. .35 cm. long, c. .15 cm. wide. Lateral sepals falcate at the base, oblong-oblanceolate, obtuse, anterior margin shortly roundly dilate at the base, 3-5-nerved, c. .47 cm. long, c. .18 cm. wide. Petals elliptic-lanceolate, acuminate, acute, 1-nerved, c. .38 cm. long, c. .10 cm. wide. Lip shortly and broadly spathulate from the narrow base, apex fleshy conic-apiculate hairy, remainder glabrous, sides suberect, provided inside in the lower 2/3 with 2 parallel glabrous keels which are dilate just below the apex and terminate rather abruptly, spread out c. .35 cm. long, c. .25 cm. wide. Column c. .17 cm. tall, sides very strongly winged. Anther cordate, acuminate, acute, keeled, c. .10 cm. long. Column foot forming a right angle with the column, c. .12 cm. long, Ovary and pedicel densely covered with long white hairs, c. .37 cm. long.

This plant is an ally of *C. lancifolia* Hook. f., from which it differs in the shorter stems, longer narrower leaves,

smaller flowers and very different lip.

S. 137, Dulit c. 500 m., August 8th, 1932, native collector. "Flowers small, white, red edge to petals."

Described from dried plants.

Podochilus lucescens Bl. Bijdr. (1825), 295; Tab. f. 12.

S. 583, Niah under 300m., November 1932, P. M. Synge. "Tree trunks in swampy ground near limestone caves in shade. Flowers small, white, tubular."

Distribution:-Java, Sumatra, Malay Peninsula,

Anamba Is; Tenasserim, Siam.

Podochilus sciuroides Rchb. f. in Bonpl. v (1857), 41.

S. 74, Dulit c. 400 feet above camp, August 3rd, 1932, *P. W. Richards*. "Clinging to bare surface of large sandstone boulder by torrent, moderate sun. Flowers white with a purple spot inside."

S. 485, Dulit ridge c. 1100 m., September 14th, 1932, P. M. Synge. "Growing on rocks near base of waterfall at lower level of moss forest. Flowers white, purple spots

on petals."

Distribution:—Sumatra, Malay Peninsula.

Appendicula anceps Bl. Bijdr. (1825), 299.

S. 101, Dulit under 300 m., August 6th, 1932, P. M.

Synge. "Flowers white, column purple."

Distribution:—Sumatra, Java, Malay Peninsula, Celebes, Natuna Is., Philippines.

Appendicula reflexa Bl. Bijdr. (1825), 301.

S. 164, Dulit under 300 m., August 10th 1932, native collector. "Flowers whitish green."

Distribution:—Sumatra, Java, Malay Peninsula, Bali, Celebes, Moluccas, N. Guinea.

Appendicula pendula Bl. Bijdr. (1825), 298.

2286, Dulit under 300 m., October 19th, 1932, native collector. "Epiphyte on tree by torrent. Ovary purplish,

rest of flower greenish yellow."

S. 69, Dulit c. 250 feet alt., August 3rd, 1932, *P. M. Synge.* "Growing on trunk of tree fern overhanging stream. Sepals pale green, pasterior petal white. Stigma brown."

Distribution:—Sumatra, Java, Malay Peninsula, Natuna Is.

Appendicula (§ Chaunodesme) niahensis sp. nov. Caules approximati, elongati. Folia ovato-elliptica, apici brevissime conduplicata subæqualiter et obtuse biloba, basi torta, vagina tubulosa. Inflorescentiæ apicales vel e nodis supremis, breves, dense paucifloræ. Bracteæ reflexæ, oblongo-obovatæ, obtusæ. Sepala lateralia triangulari-ovata, obtusa, margine antico basi in lobum anguste oblongum producto. Petala oblongo-obovata, obtusissima. Labellum panduratum, subacutum, intus basin versus callo subquadrato antice in carinas 2 breves producto dimidio superiore carina basi carnosa superne angusta donatum, apice incurvo minute apiculato.

Stems approximate, erect, up to c. 45 cm. tall, internodes c. .80 cm, long. Leaves ovate-elliptic, apex very shortly conduplicate nearly equally obtusely very shortly bilobed, base twisted, up to c. 3.35 cm. long, c. 1.35 cm. wide, upper ones smaller, sheaths tubular with funnelshaped apex. Inflorescences apical and from the uppermost nodes, short, stout, densely few-flowered, peduncle c. .50 cm. long with some short tubular imbricating sheaths at the base, rachis c. 1.10 cm. long, c. 12-flowered. strongly reflexed from the base with the apex incurved, oblong-obovate, obtuse, 5-nerved, keeled and densely furfuraceous outside, c. .47 cm. long, c. .28 cm. wide. Dorsal sepal Lateral sepals triangular-ovate, obtuse, 3-nerved, anterior margin produced at the base to a narrowly oblong lobe forming a mentum c. .35 cm. long, c. .43 cm. long, c. .33 cm. wide. Petals oblong-obovate, very obtuse, 3-nerved, c. .30 cm. long, c. .20 cm. wide. Lip pandurate, subacute, the lower ½ (claw) broadly elliptic, the upper ½ (blade) ovate, margins shortly adnate at the base to the column foot, concave, claw provided with a subquadrate callus produced in front to 2 short keels which diverge to the margins at the base of the blade; blade strongly recurved above the base, provided above the base with a fleshy median keel which is sharply attenuate towards the apex, the margins above the bend incurved. apex incurved minutely apiculate, the whole spread out c. .47 cm. long c. .23 cm. wide. Column c. .30 cm. tall, rostellum bifid, foot c. .30 cm. long, the margins shortly adnate at the base to the lip.

This is allied to A. latibracteata J. J. S. and is distinguished by the smaller leaves, very short dense inflorescence

and different flowers.

S. 601, Niah under 300 m., November 1932, P. M. Synge. Tree branch among limestone crags near top of small hill. Flowers white, no scent. Leaves slightly fleshv."

Described from a dried plant.

Appendicula longicalcarata Schltr. Orchideen (1914),291; Podochilus longicalcaratus Rolfe in Kew Bull. (1894), 186.

S. 598, Niah under 300 m., November 1932, P. M. "Growing on Aeschynanthus root on tree in moderate shade among limestone crags. Flower white with mauve edge to labellum, white spur. Leaves purplish beneath."

Distribution:—Endemic.

Plocoglottis acuminata Bl. Mus. I (1849), 46.

1035, Dulit under 300 m., July 31st 1932, P. W. "Petals pale yellow, all except labellum with Richards.deep orange-red spots."

S. 66, Dulit, August 2nd 1932, native collector.

orange with red spots. Hood (? lip) pale yellow."

S. 141, Dulit under 300 m., August 9th, 1932, native "Flowers yellow with red spots on petals. The column forms a small hood, red, Labellum yellow. vellow inside."

Distribution:-Sumatra, Java, Malay Peninsula.

Plocoglottis Lowii Rchb. f. in Gard. Chron. 1865, 434: P. porphyrophylla Ridl. in Trans. Linn. Soc. Ser. 2. Bot. III (1893), 368.

2682, Marudi forest reserve under 300 m., November

1932, P. W. Richards. "Locally abundant. Flowers yellow marked with dull crimson. beneath." Leaves reddish purple

Distribution:—Sumatra, Malay Peninsula.

Calanthe veratrifolia R. Br. in Bot. Reg. ix (1823), t. 270. 577, Niah under 300 m., November 1932, P. M. Synge. "Limestone rocks on ledge at end of cave. Petals white, tip of column bright yellow."

Distribtuion:-Java, Sumatra, Malay Peninsula. Celebes, Moluccas, Anamba Is., Philippines, India, Australia.

Calanthe pulchra Lndl. Gen. & Sp. Orch. (1833), 250: C. curculigoides Lndl. l.c. 251.

2466, Dulit trail c. 750 m., November 6th, 1932, P. W. Richards. "Perianth apricot coloured except the wings of the labellum which are scarlet."

Distribution:—Java. Sumatra. Malay Peninsula.

Philippines.

Spathoglottis Kimballiana Hook. f. in Bot. Mag. iii, 51

(1895), t. 7443.

S. 464, Dulit ridge c. 1200 m., September 12th, 1932, P. M. Synge. "Growing in small cleft in rock by edge of waterfall in moss forest. Flowers bright yellow, stem deep crimson, crimson markings on labellum. No scent."

Distribution:—Philippines (var. angustifolia Ames).

Eria Aeridostachva Rchb, f. Lndl, in Journ, Linn, Soc. III.

S. 99, Dulit c. 2000 feet above camp, 4th August, 1932, native collector. "Flowers greenish, labellum greenish

yellow. Tip of column pink."

S. 474, Dulit ridge c. 1300 m., 13th September, 1932, P. M. Synge. "Leaves blue-green, stiff. Flowers pale green with brown tip to column. Sheath at base of flower stem rich chestnut brown. Slight sweet scent."

Distribution:—Malay Peninsula.

Eria (§ Aeridostachya) dulitensis sp. nov.

Rhizoma validum. Caules ad c. 7 cm. dissiti, breves, 2-3-folii. Folia oblanceolata, oblique acuta, crasse carnosa, basi breviter petiolata. Inflorescentiæ 1-2 e nodis superiorirachide nutante stellato-pubescente, densiuscule multifloræ. Bracteæ triangulari-ovatæ, acutæ, extus stellatopubescentes. Sepala 3-nervia, extus densiuscule stellato-Sepalum dorsale ovatum, obtusum. pubescentia. lateralia falcata, ovata, obtusa, margine antico in mentum oblongum clavatum producto. Petala falcata, oblonga, obtusa, margine antico basi breviter producto, glabra. Labellum e basi breviter unguiculata elliptica, apicem versus inconspicue 3-lobum lobis brevissimis rotundatis, marginibus superne undulatis. Pes gynostemii oblongus, apicem versus leviter angustatus, medio fere carina V-formiter donatus.

Rhizome stout, elongate, covered with the remains of old fleshy sheaths, c. .85 cm. diam., internodes c. 1.50 cm. long. Stems up to c. 7 cm. distant, forming an acute angle with the rhizome, 3-4-noded, covered at first with fleshy imbricating broadly ovate or suborbicular obtuse sheaths,

cylindric, much wrinkled when dry, c. 4 cm. long, 2-3-leaved with a large articulate sheath c. 5.50 cm. long beneath the Leaves oblanceolate, obliquely acute, thickly fleshy. grooved above, keeled beneath, margins more or less revolute when dry, base gradually narrowed, c. 18.50 cm. long c. 2.10 cm. wide, petiole grooved c. 1 cm. long. Inflorescences 1-2 from the upper nodes, rather densely many-flowered, peduncle terete glabrous provided at the base with 2 very small tubular sheaths and some minute ovate bract-like appressed sheaths at intervals above c. 9.50 cm. long, rachis arched stellate-hairy c. 13 cm. long. Bracts triangular-ovate, acute, stellate-pubescent outside, fleshy, c. .18 cm. long. c. .14 cm. wide. Sepals rather densely stellate-hairy outside. Dorsal sepal ovate, obtuse, 3-nerved, c. .40 cm. long, c. .27 cm. wide. Lateral sepals falcate ovate. obtuse, 3-5-nerved, anterior margin produced at the base to form an oblong clubbed mentum c. .45 cm. long which lies at right angles with the ovary, c. .33 cm. long, c. .33 cm. wide. Petals falcate, oblong, obtuse, 3-nerved, anterior margin a little produced at the base, c. .35 cm. long, c. .17 Lip shortly clawed at the base, blade elliptic inconspicuously 3-lobed towards the apex with the lobes minute rounded, margins undulate, 3-nerved with the outer nerves branched. papillose except at the base, base apparently red remainder yellow or green, spread out c. .67 cm. long, c. .30 cm. wide. Column crimson, c. .17 cm. tall, dilate towards the apex, foot oblong narrowed towards the apex recurved above the middle provided about the middle with a crimson V-shaped keel c. .58 cm. long. Ovary and pedicel densely stellate-hairy, c. .65 cm. long.

This is a near ally of *E. reptans* Ridl. from the Malay Peninsula but it differs in the more distant stems, presence of more than one leaf and in the lip which is very much larger and more acute. The lip in *E. reptans* Ridl. is also 3-lobed but the lobing is more distinct and the midlobe very obtuse, the lip being comparatively broader and more or

less obovate in outline.

S. 463, Dulit ridge c. 1230 m., 10th September, 1932, *P. M. Synge*. "Flowers pale cream, tip of column brown. Leaves dark blue-green, stem and pseudobulbs covered with pale brown sheath."

Described from dried plants and flowers preserved in

spirit.

Eria (§ Cymboglossum) cymbidifolia Ridl. in Journ. Bot.

xxxvi (1898), 212.

S. 154, Dulit c. 300 m., 9th August, 1932, native collector. "Flowers white, crimson at base of column and on tip. Smell slightly sweet."

Distribution:—Sumatra.

Eria cymbidifolia Ridl. var. longipes var. nov.

This variety differs from the typical plants only, so far as I can see, in the elongate stems which may be found up to 22 cm. long. In all other respects, even to the keels on the lip, the plants are identical so that although the variety is so very distinct in habit I do not feel justified in considering it as a distinct species. I have found both forms together on Mount Kinabalu in British North Borneo.

S. 368, Dulit ridge c. 4000 feet alt., 30th August, 1932, E. Shackleton. "Moss forest. Flowers cream, red markings on lateral petals, on column and on inside surface of label-

lum. No scent."

S. 416 (type), Dulit ridge c. 4300 feet alt., 6th September, 1932, *P. M. Synge*. "Small tree in moss forest. Flowers white with crimson labellum, column and side petals, red spots on stalk beneath. Slight bitter scent."

Eria longifolia Hook. f. Fl. Brit. Ind. v (1890), 790; Ic.

Pl. xxi (1892), t. 2068. etc.

S. 515, Dulit ridge c. 950 m., 17th September, 1932, C. H. Hartley. "Sand forest. Flowers white, slight sweet scent."

Distribution:—Sumatra, Malay Peninsula.

*Eria punctata J. J. S. in Bull. Dep. Agr. Ind. Neerl. xiii (1907), 38; in Bull. Jard. Bot. Buit. Sér. 3, VI (1924), t. 3, F. IV.

2479, Ulu Koyan, Dulit c. 1000 m., 7th November, 1932, *P. W. Richards* "Transition' forest among moss at base of tree. Perianth dirty white with crimson spots."

Distribution:—Java, Sumatra, Malay Peninsula.

Eria nutans Lndl. in Bot. Reg. XXVI (1840), Misc. 83. etc.

S. 510, Ulu Koyan c. 900 m., 16th September, 1932, native collector. "Growing on small tree in sand forest. Flowers white, yellow at tip of labellum, pale yellow on outside of lateral petals, brownish orange at base of column."

Distribution:—Sumatra, Malay Peninsula, Natuna Is.

Trichotosia aurea comb. nov. Eria aurea Ridl. in Journ. Roy. As. Soc. Str. Br. XLIX (1908), 31: E. rhombilabris J. J. S. in Bull. Inst. Bot. Hamb. VII (1927) 50, t. 8, f. 40.

S. 498, Ulu Koyan c. 850 m., 16th September, 1932, native collector. "Small tree trunk in sand forest near ground. Flowers small, pale green petals brown tip to column. No scent."

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I cannot distinguish E. rhombilabris J. J. S. Distribution:—Endemic.

*Trichotosia aporina Krzl. in Pflanzenr. IV. 50. II. B. 21 II (1911), 150: *Eria aporina* Hook. f. Fl. Brit. Ind. V, 308; Ic. Pl. XXI (1892), t. 2081.

S. 387, Dulit under 300 m., 2nd September, 1932, P. M. Synge. "Flowers green."

Distribution:—Malay Peninsula.

Trichotosia sarawakensis sp. nov.

Caules approximati, elongati. Folia lanceolata, sub apice oblique acuminata, pungentia, pilis brevissimis bipartitis obsessa, vagina apicem versus laxe basin versus dense pilis bipartitis obsessa pilis apicem versus minutis basi dilatatis basin versus elongatis gracilibus vaginæ sub-Inflorescentiæ laxe paucifloræ, pilis longis ense obsessæ. Bracteæ ovatæ, brevissime parallelis. bipartitis dense obsessæ. acuminatæ, acutæ, extus pilosæ, pilis bipartitis. extus pilosa pilis bipartitis summi sepali subparallelis. Sepalum dorsale oblongo-lanceolatum, obtusum. lateralia ovata, breviter acuminata, obtusa, margine antico basi producta mentum oblongum obtusum formante. Petala spathulata, subacuta, extus pilis bipartitis sparse obsessa. Labellum unguiculatum, 3-lobum, ungui lineari marginibus ciliatis, intus tricarinatum carina brevi ungui lobi intermedii utringue addita, lobis lateralibus falcatis rotundate triangularibus obtusis marginibus eroso-serratis vel minute lacinulatis, lobo intermedio basi unguiculato lamina transverse reniformi lobis apicalibus rotundatis dente minuto in sinu marginibus eos loborum lateralium simulantibus.

Stems approximate, stout, leafy from above the base, c. 46 cm. long, c. .65 cm. wide at the base internodes up to c. 5 cm. long the upper ones shorter. Leaves lanceolate or linear-lanceolate, shortly obliquely acuminate, apex caudate acute, laxly and shortly hairy with the hairs bipartite, rather fleshy and coriaceous, up to c. 11.75 cm. long, .90-2.15 cm. wide, base twisted, sheath tubular ribbed laxly shortly hairy towards the apex densely hairy towards the base with the hairs bipartite and subparallel to the surface dark red. Inflorescences laxly few-flowered densely covered with long bipartite dark red hairs, peduncle provided at the base with an ovate acute hairy sheath up to c. 1.50 cm. long, rachis c. 7 cm. long sinuous. Bracts ovate, very shortly acuminate, acute, 9-nerved, densely hairy outside, hairs bipartite, c. .95 cm. long, c. .80 cm. wide. Sepals hairy outside with the hairs bipartite and more or less parallel to the surface. Dorsal sepal oblonglanceolate, obtuse, 5-nerved, c. 1.13 cm. long, c. .33 cm. wide.

Lateral sepals falcate, ovate, shortly acuminate, obtuse, 5-nerved, c. .85 cm. long, c. .50 cm. wide, the anterior margin produced at the base to form an oblong obtuse mentum c. Petals spathulate, subacute, cm. long. sparsely hairy outside, hairs bipartite, c. .80 cm. long, c. .28 cm. wide. Lip clawed to below the middle, 3-lobed, provided inside with 3 warty and papillose keels which run from above the apex of the claw to the sinus of the apical lobules of the midlobe, the outer 2 branched towards the apex, an extra short similar keel on each side on the claw of the midlobe, spread out c. 1.37 cm. long, c. .65 cm. wide across the side lobes; claw linear, a little dilate towards the apex, concave, provided along the middle in the upper 1/5 with a few warts, papillose along the nerves, margins ciliate, c. .58 cm. long; side lobes falcate, roundly triangular, obtuse, margins irregularly erose-serrate or erose-lacinulate; midlobe cuneately clawed, blade reniform, the apical lobules rounded with a minute tooth in the sinus, margins as in the side lobes, in all c. .47 cm. long, c. .55 cm. wide, claw c. .10 cm. long c. .30 cm. wide. Column c. .40 cm. tall, stigma occupying nearly the whole face transversely elliptic, foot linear, apex abruptly dilate and thickened c. .80 cm. long. Ovary densely hairy, the hairs bipartite, c. .50 cm. long.

This is a near ally of *T. unguiculata* (J. J. S.) Krzl. also a Bornean plant. It is distinguished, however, by the larger flowers and especially by the structure of the lip.

Another near allly is **T.** lacinulata (*Eria lacinulata* **J. J. S.**) Carr also from Borneo but it differs from this in the hairiness, the hairs in *T. sarawakensis* Carr being always bipartite and more or less appressed and much reduced on the upper part of the sheaths, the longer claw of the lip, the narrower midlobe with a long clawed base and the keels which are not hirtellous nor muricate. There are moreover 2 extra keels on the base of the midlobe in *T. sarawakensis* Carr.

S. 402, Dulit ridge, c. 4000 feet alt., 5th September, 1932, P. M. Synge. "Moss forest, epiphytic. Petals pale greenish brown. Labellum cream with dull pink centre and 2 side ridges. Prominent green bracts. Flower stems bear pink hairs."

Described from dried plants and flowers preserved in spirit.

*Dendrobium ustulatum Carr. in Gard. Bull. Str. Settle., VII, 1932) 13.

S. 188, Dulit under 300 m., 13th August, 1932, P. W. Richards. "Flowers whitish veined red. No scent."

Distribution:-Malay Peninsula.

- Dendrobium carnosum Rchb. f. in Walp. Ann. VI (1861) 280. etc.
- S. 602, Niah under 300 m., November, 1932, P. M. Synge. "Small tree on summit of limestone crag exposed to a fair amount of sun, leaves fleshy. Flowers deep crimson."

 Distribution:—Sumatra, Java, Malay Peninsula.
- Dendrobium babiense J. J. S. in Engl. Bot. Jahrb. XLVIII (1912), 98.
- S. 519, Dulit ridge c. 950 m., 16th September, 1932 native collector. "Petals pale yellow, labellum deeper yellow. Column white, base deep crimson, tip pale brown No scent."

Distribution:—Endemic.

- Dendrobium rosellum Ridl. in Journ. Linn. Soc. Bot XXXI (1896), 268.
- S. 3, Marudi near sea level, 25th July, 1932, *P. M Synge*. "Flowers magenta. Greenish anthers and pollinia Scentless."

Distribution:—Malay Peninsula.

- Dendrobium (§ Rhopalanthe) cinnabarinum Rchb. f. ir Gard. Chron. II. 14 (1880), 166.
- S. 518, Dulit ridge c. 1900 m., 17th September, 1932 C. H. Hartley. "Lower level of moss forest, epiphytic Flowers deep pink, petals spotted deep crimson near base Labellum pale orange with very deep crimson frilled tip Ridge near base of labellum bright orange. Column white No scent."

D. cinnabarinum Rchb. f. appears to show a wide range of variation both in dimensions and the colouring of the flowers. Normally the sepals are oblong-obovate but in S 518 the lateral sepals are distinctly clawed with the blade broadly elliptic and measure 4.10×2.40 cm. The petals in S. 518, which is an unusually large-flowered example, are shortly clawed with the blade greatly dilate and suborbicular in outline and measure 3.55×2.50 cm. The lip varies considerably in all plants I have examined. It has the margins shortly adnate at the base to the column foot and there are 3 keels which do not always rise at the base and which reach to the base of the midlobe while there are ofter 1-2 extra short keels on each side at the base of the lip; it is usually glabrous but in S. 518 it is minutely papillose near the base; the midlobe varies considerably in the length of the triangular claw, the blade being lanceolate to oblong or elliptic with the margins more or less undulate and some times very strongly so and there is often an elevate mediar line. The column arms are falcately recurved, triangular

caudate and are often provided about the middle with 1-2 minute teeth. The column foot is sometimes keeled inside and sometimes bears a conic tubercle below the apex.

Distribution:—Endemic.

Var. angustitepalum n. var. Dendrobium sanguineum Rolfe in Gard. Chron. (1895) II, 292.

S. 481, Ulu Koyan c. 1100 m., 15th September, 1932, P. W. Richards. "Petals crimson scarlet, pale lilac at base. Lip deep crimson with white frilled edge. Tip of column yellow."

Dr. F. Kränzlin, in Pflanzenreich IV, 50, II, B. 21, 237 reduces D. sanguineum Rolfe to D. cinnabarinum Rohb. f. While agreeing that the two plants cannot be kept separate as distinct species there are at the same time such marked differences as to render it advantageous to regard the present plant as a distinct variety based upon the very narrow sepals and petals. In the type of D. sanguineum Rolfe the sepals are narrowly oblong-oblanceolate, the dorsal $2.25 \times .53$ cm., the laterals $2.38 \times .55$ cm. The petals are spathulate and measure $2.20 \times .90$ cm. The midlobe of the lip is narrower than in the typical D. cinnabarinum and the margins are closely and densely undulate.

In S. 481 the dorsal sepal measures $2.35\times.45$ cm, the laterals $2.70\times.55$ cm. and the petals which are oblanceolate above the clawed base measure $2.28\times.47$ cm. The lip measures when spread out $2.20\times.68$ cm. across the side lobes and the midlobe is long and tapering to an acute apex and measures $1.40\times.28$ cm. at the base. There is no callus near the apex of the column foot.

Var. lamelliferum n. var.

S. 473, Dulit ridge c. 1300 m., 13th September, 1932, P. M. Synge. "Growing in moss forest as epiphyte in moderately open spots. Flowers brilliant scarlet."

This variety differs from the type by the lower half of the blade of the lip bearing a dense cover of long ciliate lamellæ the lamellæ being broad and much branched, narrow and few-branched or single and hair-like. The keels of the lip end in similar though much shorter lamellæ and there are 2 very short similar keels on each side at the base. Above the keels there is a thickened median bar which runs to the apex of the lip and includes the 3 inner nerves which are minutely warty. There is a subglobose warty tubercle below the apex of the column foot.

Dendrobium (§ Rhopalanthe) ventripes sp. nov.

Caules approximati, basi cylindrici, super basin internodiis 2-3 in pseudobulbum anguste fusiformem dilatatis,

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superne complanati sectioni transversa anguste elliptici usque ad apicem foliosi. Folia lanceolata vel oblongo-lanceolata, sub apice abrupte angustata, inæqualiter et obtuse Inflorescentiæ e nodis supremis caulium inter biloba. folios, brevissimæ, unifloræ, basi squamis siccis cinctæ. Sepalum dorsale ovatum, subacutum. Sepala lateralia subfalcata, ovata, obtusa, margine antico basi in mentum oblongum obtusum producto. Petala e basi breviter unguiculata lanceolata, obtusa. Labellum 3-lobum, basi concavum, lobis lateralibus tortis oblongis obtusis apice denticulatis, lobo intermedio crasse carnoso quadrilateraliter Gynostemium brevi, rectum, pede apicem cvlindrico. versus rotundatim dilatato et valde concavo tubercula minuta sub apice.

Stems approximate, base cylindric, 2-3 internodes above the base thickened into a narrowly fusiform manygrooved pseudobulb constricted at the nodes and up to c. 9.50 cm. long, above the pseudobulb much flattened and narrowly elliptic in section, up to c. 62 cm. long, leafy to the apex, internodes dilate upwards with the lowest largest c. 3.33 cm. long c. .45 cm. wide uppermost c. .50 cm. long. Leaves lanceolate or oblong-lanceolate, abruptly narrowed below the apex, shortly unequally obtusely bilobed, thinly coriaceous, grooved above, keeled beneath, base twisted, lower leaves largest c. 3.70 cm. long .50-.93 cm. wide, apical leaves c. 1.10 cm. long, sheaths tubular winged. Inflorescences from tufts of dry scales at the highest nodes among the leaves, very short, 1-flowered. Sepals and petals rather fleshy. Dorsal sepal ovate, subacute 5-nerved, c. .57 cm. long, c. .40 cm. wide. Lateral sepals subfalcate, ovate. obtuse, 7-nerved, c. .55 cm. long, about as broad, dilate at the base to form an oblong obtuse mentum c. .40 cm. long. Petals lanceolate above the shortly clawed base, obtuse, 3-nerved, c. .45 cm. long, c. .15 cm. wide. Lip 3-lobed, base concave, spread out c. 1.30 cm. long, c. .50 cm. wide across the side lobes; side lobes twisted, erect, much exceeding the midlobe, oblong, apex incurved obtuse and denticulate, towards the apex shortly hairy with the margins ciliate, c. .35 cm. long, c. .15 cm. wide; midlobe thickly fleshy. quadrilaterally cylindric, dilate towards base and apex, in the upper ½ recurved abruptly triangularly acuminate keeled with a short tubercular keel on each side below the apex, c. .18 cm. long. Column straight, c. .15 cm. tall, arms triangular blunt; foot oblong, roundly spathulately dilate in the upper ½ and ventricose with a minute tubercle in the middle of the depression, c. .67 cm. long.

A rather distinct species characterized by the stems being leafy to the apex, the curious lip structure and the ventricose column foot.

S. 422 (type), Dulit ridge c. 4000 feet alt., 6th September, 1932, *P. M. Synge*. "Moss forest. Flowers green with crimson markings on petals and labellum, borne on underneath of stems hidden by leaves from above. No scent."

S. 461, Dulit ridge c. 1240 m., 10th September, 1932, P. M. Synge. "Moss forest. Flowers pale greenish yellow with brown markings on petals and column."

Described from dried plants.

Dendrobium (§ Rhopalanthe) gynoglottis sp. nov.

Caules approximati, super basin internodiis 2-3 in pseudobulbum lanceolatum tenuem nodiis leviter constrictum valde dilatati, superne complanati foliosi, apicem versus leviter flexuosi interdum efoliosi. Folia anguste lanceolata, brevissime inæqualiter obtuse biloba vel obliqua, textura tenuiuscula. Inflorescentiæ e nodiis superioribus, brevissime, unifloræ. Sepalum dorsale ovato-ellipticum, obtusum. Sepala lateralia ovata, obtusa, basi in mentum oblongum acuminatum anguste obtusum dilatata. Petala e basi angusta obovata, obtusissima. Labellum longe unguiculatum, superne 3-lobum, ungui marginibus pedi gynostemii adnatis papilloso, lamina oblonga basin versus pilosa tricarinata lobis lateralibus brevibus subulatis, lobo intermedio subquadrato apici obtuso vel inconspicu bilobulo. Pes gynostemii sub apice tuberculam transversam semiovalem donatus.

Stems approximate, base cylindric rather flattened, 2-3 internodes above much dilated into a lanceolate flattened and thin pseudobulb a little constricted at the nodes and up to c. 8.50 cm. long c. 1.70 cm. wide, flattened above and narrowly elliptic in section, leafy, a little flexuous and sometimes leafless towards the apex, c. 57 cm. long, internodes up to c. 3.70 cm. long c. .35 cm. wide. Leaves narrowly lanceolate, very shortly unequally obtusely bilobed or oblique, rather thin in texture, up to c. 8.60 cm. long, c. 1.10 cm. wide, sheaths tubular. Inflorescences from tufts of dry scales at the upper nodes, fascicled, very short, 1-flowered. Dorsal sepal ovate-elliptic, obtuse, 3-nerved, c. .70 cm. long, c. .40 cm. wide. Lateral sepals ovate, obtuse 5-nerved, c. 1 cm. long, c. .65 cm. wide, base dilate to an oblong acuminate narrowly obtuse mentum c. .95 cm. long. Petals obovate from the narrow base, very obtuse, 3-nerved with the outer nerves branched above the base, c. .65 cm. long, c. .27 cm. wide. Lip clawed, 3-lobed, the blade oblong

hairy at the base and provided with 3 keels which terminate abruptly about the middle of the midlobe, spread out c. 1.90 cm. long, c. .80 cm. wide across the side lobes; claw linear, cuneately dilate towards the apex, margins adnate to the column foot forming a spur, papillose inside, c. .80 cm. long; side lobes arising from c. ½ below the apex of the lip, subulate, free part c. .15 cm. long; midlobe subquadrate, obtuse or inconspicuously bilobed, c. .45 cm. long and as broad. Column c. .25 cm. tall, arms falcate triangular acute toothed, foot linear with a small transverse semioval tubercle below the apex c. 1.15 cm. long.

This is an ally of *D. incurvociliatum* J. J. S. from Central East Borneo but the flowers differ materially. In the present plant the claw of the lip is adnate to the column for a much greater distance and the midlobe is quite

different.

S. 505, Ulu Koyan c. 900 m., 16th September, 1932, native collector. "Flowers white, crimson markings on outside of petals, pale orange at the base of spur; pale orange ridges on labellum. No scent. Leaves purplish green."

Described from a dried plant.

Dendrobium lamelluliferum J. J. S. in Bull. Inst. Allg.

Bot. Hamb. VII (1927), 53, t. 8, f. 43.

S. 444, Dulit ridge c. 1230 m., 6th September, 1932, P. M. Synge. "Flowers creamy yellow, bright yellow tip to column. Stem brown. Pseudobulbs chestnut brown, ribbed."

This plant differs from that described by J. J. Smith in the narrower leaves and the glabrous lip.

Distribution:—Endemic.

Dendrobium sculptum Rchb. f. in Bot. Zeit. XXI (1863), 128; Xen. Orch. II (1868), 131, t. 146.

S. 421, Dulit ridge c. 4000 feet alt., 6th September, 1932, P. W. Richards and P. M. Synge. "Epiphytic in moss forest. Flowers white, orange at base of labellum. No scent."

Distribution:—Endemic.

Dendrobium bifarium Lndl. in Wall. Cat. (1828) n. 2002, nomen nudum; Hook. f. Fl. Brit. Ind. V (1890), 732.

S. 78, Dulit c. 2000 feet above camp, 3rd August, 1932, E. Shackleton. "Flower white, labellum pale yellow with white ridges. Stems yellowish."

Distribution:—Malay Peninsula, Amboina.

Dendrobium villosulum Lndl. Gen. & Sp. Orch. (1830) 86; Hook. f. Fl. Brit. Ind. V (1890), 728. etc. S. 355, Dulit c. 2600 feet alt., 29th August, 1932, P. M. Synge. "Growing on edge of rock under dripping water. Flowers white, spur pale orange. Tip of column yellowish. No scent."

S. 450, Dulit ridge c. 1200 m., 10th September, 1932, P. M. Synge. "Growing under waterfall in moss forest.

Flowers cream coloured."

S. 459, Dulit ridge c. 1230 m., 10th September 1932, P. M. Synge. "Growing on rock crevice in moss forest. Flowers white, pale pinkish brown at base of column."

Distribution:—Malay Peninsula, ? Bangka, ? Sumatra.

Dendrobium lamellatum Lndl. Gen. & Sp. Orch. (1830), 89, etc.

S. 82, Dulit c. 1500 feet above camp, 4th August, 1932, P. M. Synge. "Flower white, labellum yellow on inner surface."

S. 350, Dulit c. 2000 feet alt., 27th August, 1932, native collector. "Flowers white, pale green inside hood, two ridges of very pale mauve along edge of column. No scent."

Distribution:—Sumatra, Java, Malay Peninsula,

Natuna Is., Tenasserim.

Dendrobium (§ Calcarifera) calcariferum sp. nov.

Caules approximati, elongati, foliosi, graciles. lineari-lanceolata, breviter acuminata. oblique Inflorescentiæ ad. c. 6-floræ, laxæ. Bracteæ ovatæ, acutæ, Sepalum dorsale ovato-lanceolatum, obtusum. Sepala lateralia oblongo-ovata, subacuta, basi in mentum oblongum anguste obtusum producta. Petala late lanceolata-oblonga, apici truncata minute apiculata. longe unguiculatum, ungui basi cuneato marginibus pedi gynostemii adnatis medio fere carinis 2 altis parallelis apicem versus divergentibus et margine evanescentibus abrupte donato, lamina obcordata lobis rotundatis carinis 2 sub medio altissimis ex ungui usque ad apicem labelli donata marginibus basi in pulvinum oblongum verrucosum incrassatis superne denticulatis vel eroso-crenulatis. Gynostemii alæ magnæ, subquadratæ, falcatæ, minute apiculatæ.

Stems approximate, rather slender, wrinkled, flexuous, c. 42 cm. long, internodes c. 2.80 cm. long. Leaves linear-lanceolate, shortly acuminate, obliquely acute, rather thinly coriaceous, c. 9.70 cm. long, 1.30-2 cm. wide, sheath tubular a little shorter than the internode. Inflorescences appearing from the upper nodes of the leafy stem first then downwards as the leaves fall, forming an acute angle with the stem, laxly up to c. 6-flowered, peduncle provided with a tubular sheath at the base and a very small ovate acute sheath above c. 1.75 cm. long, rachis c. 3 cm. long. Bracts ovate,

acute, c. .15 cm. long. Dorsal sepal ovate-lanceolate, obtuse. 7-nerved, c. 1.20 cm. long, c. .60 cm. wide. Lateral sepals oblong-ovate, subacute, 7-nerved c. 1.27 cm. long, c. .60 cm. wide, base produced to an oblong mentum with conic narrowly obtuse apex c. 1.10 cm. long. Petals broadly lanceolate-oblong from a cuneate base, apex subobliquely truncate with a minute apiculus, 3-nerved with the outer nerves much branched, c. 1.40 cm. long, c. .65 cm. wide. Lip long clawed to a little below the middle, blade obcordate with rounded lobes, spread out c. 2.45 cm. long to sinus of lobes, c. 2.70 cm. long to apex of lobes, c. 1.05 cm. wide: claw linear, cuneately narrowed at the base for c. .40 cm. with margins adnate to the column foot, provided about the middle with 2 abruptly elevate keels which are joined at the base and are parallel for c. .35 cm. then diverge abruptly to the margins, c. 1.20 cm. long; blade provided along the middle with 2 rounded keels which run from the claw to the sinus of the apical lobes and are highest about the middle, margins provided at the base with an oblong verrucose cushion, remainder minutely denticulate or erosecrenulate. Column including arms c. .43 cm. tall, arms falcate, subquadrate with a minute apiculus c. .20 cm. long. Column foot linear, a little incurved towards the apex, c. 1.30 cm. long.

This plant is well characterized by the broad truncate petals fully as broad as the sepals, the bilobed lip with its A -shaped keel on the claw, the rounded keels on the blade and the warty cushions on the margins at the base of the blade and the very large subquadrate column arms.

2404, Gunong Balapan, Ulu Tinjar, c. 600-900 m., 2nd November, 1932, P. W. Richards. "Perianth segments white with faint magenta stripes except the throat and the spurred petal (? lip) which are tinged with orange-red."

Described from a dried plant.

Diplocaulobium longicolle Krzl. in Engl. Pflanzen. IV. 50. II. B. 21, 340; Dendrobium longicolle Lndl. in Bot. Reg.

XXVI (1840), Misc. 74. etc. 2334, Dulit under 300 m., 26th September, 1932, "Long perianth segments dull red fading P. W. Richards. through yellow to cream colour at expanded base. Labellum pale yellow with bright yellow appendage. Rest of flower pale vellow."

Distribution:—Malay Peninsula.

Sarcopodium labuanum Krzl, in Engl. Pflanzen, IV. 50. II. B. 21, 321; Dendrobium labuanum Lndl. in Journ. Linn. Soc. Bot. III (1859), 6. etc.

S. 517, Dulit ridge c. 1350 m., 17th September, 1932, P. M. Synge. "Petals outside pink, inside pale pink, lip

pale yellow bright yellow at tip. Column white, tip pale yellow. Pseudobulbs chestnut."

Distribution:—Endemic.

Sarcopodium suberectum Ridl. in Kew Bull. (1914), 211.

S. 462, Dulit ridge c. 1300 m., 10th September, 1932, P. W. Richards, "Flowers pale vellow, labellum white with crimson and yellow markings. Inflorescence dark crimson. Leaves deep green with crimson edges and centre rib. Sweet scent.

Distribution:—Endemic.

Sarcopodium speculum new comb. Dendrobium speculum J. J. S. in Bull. Dep. Agr. Ind. Neerl. V (1907), 34;

Ic. Bog. III. (1907) 99, t. 241.

S. 499, Dulit ridge c. 900 m., 16th September, 1932, P. M. Sunge. "Flowers pale cream, purple stripes on labellum and inside column. Sweet scent. Pseudobulbs deep olive green."

Distribution:—Endemic.

*Bulbophyllum pileatum Lndl. in Bot. Reg. XXX (1844), Misc. 73, etc.

S. 77, Dulit c. 2000 feet above camp, 4th August, 1932, P. M. Synge. "Tree trunk in moderate sun in rain forest, about 15 feet from ground. Scentless. Flowers pale orange. labellum yellow with orange streak in centre and crimson on sides.'

Distribution:—Sumatra, Malay Peninsula.

Bulbophyllum Lobbii Lndl. in Bot. Reg. XXXIII (1847). sub t. 29; Bot. Mag. t. 4532. etc.

S. 76, Dulit c. 800 m., 4th August, 1932, P. M. Synge. "Flower orange in colour, petals veined red, lip yellow with orange spots. Column slightly spotted red. Red spot on underneath of tip of labellum. No scent." The specimen consists of a single flower without any vegetative parts.

2626, Dulit, 18th November, 1932, native collector. "Perianth dull orange yellow marked with dull red." The specimen consists of a single pseudobulb and leaf and an

inflorescence and flower.

Distribution:—Sumatra, Java, Malay Peninsula, Bali,

*Bulbophyllum uniflorum Hassk. Cat. Bog. (1844), 39. etc.

2446, Gunong Balapan, Ulu Tinjar, between 600 and 1000 m., 2nd November, 1932, native collector. "Upper lip of flower dull orange, lateral perianth segments orange tinged with magenta, labellum magenta."

Distribution:—Sumatra, Java, Malay Peninsula.

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*Bulbophyllum fætidolens Carr. in Gard. Bull. Str. Settle.

V (1930), 135, t. III, f. 2.

S. 341, Dulit c. 2000 feet altitude, 27th August, 1932, P. M. Synge. "Growing with moss on sloping rock face in primary forest. Flowers dull crimson. Smell very strong of bad carrion."

2481, Ulu Koyan, Dulit c. 1000 m., 7th November, 1932, native collector. "Perianth segments pale greenish the apices of the three upper ones tinged with magenta, labellum dull yellow with minute magenta spots."

Distribution:—Malay Peninsula.

Bulbophyllum (§ Globiceps) reflexum A. & S. Orch. VI (1920), 192.

S. 559, Dulit ridge c. 1300 m., 7th October, 1932, native collector. "Fairly common. Flowers brownish white with brown centre. No scent. Flower stalk crimson. Leaves bright yellow-green."

Distribution:—Endemic.

Bulbophyllum tacitum sp. nov.

Pseudobulbi approximati, ovoidei, 1-folii. Folium oblanceolatum ad oblongo-obovatum, coriaceum, basi breviter petiolatum. Inflorescentiæ 2 e basi pseudobulbi, breves, arcuatæ, dense multifloræ. Bracteæ lanceolatæ, acutæ. Sepala extus breviter et sparse pilosa. Sepalum dorsale oblongo-lanceolatum, breviter acuminatum, acutum. Sepala lateralia oblonga, longe caudata, margine antico basi breviter dilatato. Petala e basi unguiculata elliptica vel anguste obovata, acuta. Labellum integrum, marginibus dimidio inferiore erectis contiguisque (sicco), explanatum panduratum, obtusum.

Pseudobulbs approximate, base forming an acute angle with the rhizome, apex a little recurved, ovoid, wrinkled when dry, c. .50 cm. long, 1-leaved. Leaf oblanceolate, or oblong-obovate, sometimes very shortly acuminate, apex conduplicate acute, coriaceous, up to c. 11 cm. long, 3.60 cm. wide, petiole .50-1.50 cm. long. Inflorescences 2 from the base of each pseudobulb, short, concealed by the leaves, peduncle c. 1.30 cm. long, base covered with imbricating tubular sheaths with a larger ovate acute spreading sheath above, rachis thickened many-ribbed arched very densely many-flowered c. 1.20 cm. long. Bracts lanceolate, acute, spreading, c. .40 cm. long. Sepals shortly sparingly hairy outside. Dorsal sepal oblong-lanceolate, shortly acuminate, acute, 3-nerved, c. .47 cm. long, c. .18 cm. wide. Lateral sepals oblong, rather abruptly long caudate for c. .28 cm., base falcate, 3-nerved, anterior margin a little dilate at the base, c. .80 cm. long, c. .25 cm.

wide. *Petals* shortly clawed at the base, blade elliptic or narrowly obovate, acute, falcate, 1-nerved, c. .27 cm. long, c. .08 cm. wide. *Lip* entire, margins in the lower ½ erect and contiguous (in dried plants), concave inside, when spread out pandurate obtuse c. .30 cm. long, c. .17 cm. wide, no keels nor calli. *Column* including the arms c. .10 cm. tall, arms cuneate with trilobulate apex, foot oblong strongly incurved towards the apex provided at the base with a short median keel c. .20 cm. long.

This plant is an ally of *B. poekilon* Carr from the Malay Peninsula which it resembles much in habit. The flowers

are, however, very different.

S. 26, Marudi near sea level, 25th July, 1932, *P. M. Synge*. "Leaves purplish below, green above. Flowers purplish. Scentless. Flowers hang in clusters completely hidden by leaves."

Distribution:—Endemic.

Bulbophyllum (§ Hybochilus) marudiense sp. nov.

Rhizoma gracillimum, longe repens, ramosum. Pseudobulbi ad c. 2.30 cm. dissiti, ovoidei, rugosi, 1-folii. Folium ovatum vel oblongo-ovatum, tenuiter coriaceum, minute apiculatum, brevissime petiolatum. Inflorescentiæ e basi pseudobulborum vel ex nodiis, brevissimæ, unifloræ. Bractea infundibuliformis. Sepalum dorsale oblongum, triangulari-acuminatum, acutum. Sepala lateralia oblongo-ovata, acuminata, acuta, falcata, margine antico basin versus brevissime dilatato. Petala e basi breviter cuneato-unguiculata oblonga, breviter acuminata, acuta. Labellum explanatum et supra visum ovatum, acuminatum, obtusum, papillosum, basi brevissime cuneato-unguiculatum.

Rhizome long creeping, very slender, branched, emitting a few roots from each pseudobulb, c. .04 cm. diam. Pseudobulbs up to c. 2.30 cm. distant, ovoid, wrinkled, up to c. .50 cm. tall, c. .25 cm. wide, 1-leaved. Leaf ovate or oblong-ovate, minutely apiculate, thinly coriaceous, .50-1.75 cm. long, .35-.65 cm. wide, base very abruptly narrowed to a grooved petiole c. .05 cm. long. Inflorescence 1-2 from the base of each pseudobulb or from the nodes, very short, 1-flowered, peduncle c. .20 cm. long base covered with minute tubular imbricating sheaths. Bract funnel-shaped, c. .10 cm. long. Dorsal sepal oblong, triangular-acuminate from above the middle, acute, 3-nerved, c. .27 cm. long, c. .10 cm. wide. Lateral sepals oblong-ovate, acuminate, acute, falcate, keeled on the back, anterior margin a very little dilate near the base, 3-nerved, c. .27 cm. long, c. .13 cm. wide. Petals shortly cuneate-unguiculate at the base, blade oblong, shortly acuminate, acute, 1-nerved, c. .15 cm. long,

c. .06 cm. wide. Lip base erect recurved above the base, strongly recurved towards the apex, entire, base very shortly cuneate-unguiculate, blade when spread out ovate acuminate obtuse, concave in the lower 1/2 with a low median elevate nerve, papillose inside, c. .15 cm. long, c. .08 cm. wide. Column c. .07 cm. tall, arms ending in a subulate tooth, foot c. .10 cm. long.

This is an ally of *B. acutum* J. J. S. from Sumatra and Java but it differs in the structure of lip and column.

S. 2, Marudi near sea level, 25th July, 1932, P. M. Synge. "Sandy forest growing affixed to Podocarpus shrubs about 6 feet from ground with small liverwort. Pseudobulbs green. Flowers red."

Described from dried material.

Bulbophyllum (§ Aphanobulbon) flavescens Lndl. Gen. & Sp. Orch. (1830), 54. etc.

2309, Dulit under 300 m., 21st October, 1932, P. W. Richards. "Flowers pale yellow."

Distribution:—Sumatra, Java.

Bulbophyllum exiliscapum J. J. S. in Bull. Inst. Bot. Hamb. VII (1927), 64, t. X, f. 53.

- S. 79, Dulit c. 250 feet above camp, 3rd August, 1932, *P. W. Richards.* "Tree trunk near stream in moderate sun. Flowers white. Scentless."
- S. 239, Dulit under 300 m., 18th August 1932, native collector. "Tree trunk in primary forest, moderately common. Flowers cream, scentless."

Distribution:—Endemic.

- Bulbophyllum barrinum Ridl. in Sarawak Mus. Journ. I (1912), 32.
- S. 155, Dulit c. 300 m., 10th August, 1932, native collector. "Flowers creamy. No smell."
- S. 514, Dulit ridge c. 950 m., 17th September, 1932, C. H. Hartley. "Flowers pale orange-yellow. No scent." Distribution:—Endemic.

Bulbophyllum (§ Aphanobulbon) koyanense sp. nov.

Pseudobulbi approximati, breves, cylindrici, 1-folii. Folium lineari-oblongum vel lineari-oblanceolatum, apici conduplicatum et obtusum, petiolo canaliculato vagina magna ampliata tubulosa incluso. Inflorescentiæ 2 e basi pseudobulbi folio multo breviores, laxiuscule multifloræ. Bracteæ elliptico-lanceolatæ, acuminatæ, acutæ. Sepala apici carnosa. Sepalum dorsale lineari-oblongum, acuminatum, breviter caudatum. Sepala lateralia ovato-oblonga, acuminata, caudata, basi mentum breve formantia. Petala

oblongo-oblanceolata, breviter acuminata, acuta, dimidio superiore papillosa. Labellum explanatum ovatum, obtusum, marginibus dimidio superiore ciliatis. Gynostemii stelidia porrectis subulatis, pede apicem versus incurvo egibboso.

Pseudobulbs approximate, longer than broad, cylindric wrinkled, at first covered together with the petiole in a large loose tubular sheath c. 6.50 cm. long, c. .55 cm. tall, c. .40 cm. diam., 1-leaved. Leaf linear-oblong or linear-oblanceolate. apex conduplicate and obtuse, thinly coriaceous, grooved above, keeled beneath, sometimes a little curved, c. 18 cm. long, c. 2.75 cm. wide, petiole grooved more than half concealed at first by the large loose tubular sheath c. 7 cm. long. Inflorescences 2 from the base of the pseudobulb, enclosed with the petiole in the basal sheath, much shorter than the leaves, slender, rather laxly many-flowered, peduncle provided at the base with some short tubular sheaths and with c. 3 larger tubular sheaths up to c. 1.70 cm. long with shortly free acute apex at intervals above, c. 5.30-7.50 cm. long, rachis 6-11 cm. long. Bracts longer than pedicel and ovary, elliptic-lanceolate, acuminate, acute, 1-nerved, c. .35 cm. long, c. .12 cm. wide. Apex of sepals fleshy and very shortly caudate. Dorsal sepal linear-oblong, acuminate, inconspicuously narrowed above the base, 3-nerved, c. .55 cm. long, c. .14 cm. wide. Lateral sepals ovate-oblong, acuminate, falcate, 3-nerved, anterior margin roundly produced at the base to form a mentum c. .09 cm. long, c. .55 cm. long, c. .18 cm. wide. Petals oblonglanceolate, shortly acuminate, acute, papillose and fleshy in the upper half, falcate, 1-nerved, c. .17 cm. long, c. .08 cm. Lip erect with erect margins at the base, very strongly recurved above the middle, 3-nerved, when spread out ovate, obtuse, margins ciliate above the middle, c. .20 cm. long, c. .12 cm. wide. Column short, straight, including the porrect straight subulate stelidia c. .12 cm. tall; foot oblong, apex incurved very shortly free, no callus nor distinct incrassation at the base, c. .15 cm. long. Anther ovate, triangularly narrowed towards the obtuse apex, keeled above. *Pollinia* 2, roundly triangular as seen from the side, flattened inside, exappendiculate.

The nearest affinity of this plant appears to be *B. flavescens* Lndl. *var. temelenense* J. J. S. also from Borneo. It differs however in the taller pseudobulbs, longer petioled narrower leaves, the inflorescences enclosed by the large basal sheath and in various details of the parts of the flower.

S. 541, Ulu Koyan c. 950 m., 22nd September, 1932, P. M. Synge. "Slight scent. Flowers bright yellow. Flower stalk pale green."

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Described from dried material.

Bulbophyllum (§ Aphanobulbon) dulitense sp. nov.

Pseudobulbi and c. 4 cm. dissiti, breves, cylindrici. Folium oblongum vel oblongo-lanceolatum, apici 1-folii. conduplicatum obtusum, tenuiter coriaceum, basi longe petiolatum, petiolo canaliculato vagina magna ampliata Inflorescentiæ 1-2 e basi pseudobulbi tubulosa incluso. folium multo superantes, densiuscule multifloræ. Bracteæ ovato-lanceolatæ, acutæ. Sepala longe caudata. Sepalum dorsale oblongum, acuminatum. Sepala lateralia triangulari-oblonga, breviter acuminata, margine antico breviter rotundatim dilatato. Petala oblanceolata, acuta, basi unguiculata. Labellum integrum, explanatum dimidio inferiore ovato vel suborbiculari, dimidio superiore oblongo obtuso marginibus ciliolatis.

Rhizome stout, branched, densely rooting, at first covered with rather fleshy sheaths, c. .55 cm. diam., when dry. Pseudobulbs up to c. 4 cm. distant, longer than broad, wrinkled, cylindric, c. .63 cm. tall, c. .55 cm. wide, at first concealed by 3-4 tubular imbricating rather fleshy sheaths of which the uppermost or largest c. 7.50 cm. tall more than half encloses the leaf petiole, 1-leaved. Leaf oblong or oblong-lanceolate, apex conduplicate obtuse, rather thinly coriaceous, grooved above, keeled beneath, sometimes a little curved, up to c. 25 cm. long, c. 5.20 cm. wide, base cuneately narrowed to a grooved petiole up to c. 10.50 cm. long. Inflorescences 1-2 from the base of the pseudobulb, enclosed with the petiole in the sheath, erect, much longer than the leaves; peduncle stout, provided at the base with some short tubular sheaths and with c. 5 larger tubular sheaths at intervals above of which the upper 2 or largest measure c. 6 cm. in length, c. 33 cm. long; rachis rather dense, subverticillate towards the base, c. 29 cm. long. *Bracts* much longer than pedicel and ovary, ovate-lanceolate, acute, 1-nerved, c. .75 cm. long, c. .20 cm. wide. Dorsal sepal oblong, acuminate, long caudate, 3-nerved, in all c. 1.10 cm. long, c. .15 cm. wide, caudate part c. .45 cm. long. Lateral sepals triangular-oblong, shortly acuminate, long caudate, 3-nerved, anterior margin very shortly roundly dilate at the base, in all c. 1.30 cm. long, c. .24 cm. wide at the base, caudate part c. .60 cm. long. Petals oblanceolate, acute, clawed at the base, 1-nerved, papillose in the upper half with ciliolate margins, c. .24 cm. long, c. .07 cm. wide. Lip entire or inconspicuously 3-lobed with the lobes rounded. base concave with erect margins, recurved convex above the middle, 3-nerved, spread out ovate or suborbicular in the lower half, oblong obtuse with ciliolate margins in the upper

half, c. .32 cm. long, c. .13 cm. wide. *Column* including the porrect straight subulate stelidia c. .10 cm. long, clinand-rium margin with a minute tooth on each side; foot oblong, apex a little incurved and very shortly free, transversely thickened at the base, c. .16 cm. long. *Pollinia* 2, roundly triangular, flattened inside, exappendiculate.

This plant is allied to the preceding but is much larger

in all parts and has different sepals.

S. 516 (type), Dulit ridge c. 1250 m., 17th September, 1932, P. M. Synge. "Flowers cream, labellum and tip of column pale yellow. Slight sweet scent."

S. 478, Dulit ridge c. 1200 m., 14th September, 1932, native collector. "Flowers pale cream, tip of column yellow."

Described from dried plants.

Bulbophyllum breviflorum Ridl. in Stapf in Trans. Linn. Soc. Ser. 2, IV (1894) 326.

S. 445, Dulit ridge c. 1230 m., 7th September, 1932, P. M. Synge. "Moss forest. Flowers creamy yellow." Distribution:—Endemic.

Bulbophyllum Gibbsiæ Rolfe in Gibbs in Journ. Linn. Soc. XLII (1914), 149.

2477, Ulu Koyan c. 800 m., 7th November, 1932, P. W. Richards. "Flowers uniform pale creamy yellow. Leaves succulent."

Distribution:—Endemic.

Bulbophyllum (§ Aphanobulbon) teres sp. nov.

Pseudobulbi approximati ad 1.50 cm. dissiti disciformes, 1-folii. Folium teres, succosum, supra canaliculatum, basi petiolato-angustatum, apici pungens. Inflorescentiæ 1-2 e basi pseudobulbi, folia superantes, densiuscule multifloræ. Bracteæ ovatæ, acuminatæ, acutæ. Sepalum dorsale oblongum, obtusum. Sepala lateralia falcata, ovata, acuminata, obtusa. Petala e basi breviter unguiculata oblanceolata, obtusa, subfalcata, glabra. Labellum integrum, glabrum, ecallosum, oblongum., obtusum. Pes gynostemii egibbosus.

Rhizome creeping, branched, densely rooting, c. .25 cm. diam., internodes up to c. .65 cm. long. Pseudobulbs approximate to 1.50 cm. distant, disciform, forming an acute angle with the rhizome, concealed at first together with the leaf base by large tubular sheaths, wrinkled, c. .20 cm. long and as broad, 1-leafed. Leaf recurved from the base, straight or curved, terete, succulent, grooved above, apex pungent, base narrowed in the form of a petiole, up to 9.40 cm. long, c. .45 cm. diam. Inflorescences 1-2 from within

the remains of the sheath at the base of the pseudobulb. longer than the leaves, rather densely many-flowered, peduncle almost entirely concealed by loose tubular imbricating sheaths up to c. 3 cm. long, rachis up to c. 8 cm. long. *Bracts* a little exceeding half the length of pedicel and ovary, ovate, acuminate, acute, c. .15 cm. long. Dorsal sepal oblong obtuse, 3-nerved, c. .33 cm. long. c. .13 cm. wide. Lateral sepals falcate, ovate, acuminate, obtuse. anterior margin indistinctly roundly dilate above the base. 3-nerved, keeled on the back, c. .30 cm. long, c. .20 cm. wide. Petals shortly clawed at the base, blade oblanceolate, obtuse. subfalcate, 1-nerved, entirely glabrous, not papillose, apex very shortly thickened, c. .17 cm. long, c. .06 cm. wide. Lip entire, concave in lower half, recurved convex in upper half, glabrous or minutely papillose towards the apex. 3-nerved, keels O, spread out oblong obtuse c. .18 cm. long, c. .13 cm. wide. Column c. .08 cm. tall, stelidia triangular acuminate acute; foot oblong, apex very shortly free and a little incurved, callus at base O. Pollinia 2, roundly triangular, flattened inside, exappendiculate.

This plant is perhaps nearest to *B. Gibbsiae* Rolfe. In vegetative characters it much resembles the Javanese *B. alliifolium* but it is of stouter habit, the inflorescences are denser and the flowers rather different. As in the case of *B. stipitatibulbum* J. J. S. the pseudobulbs appear to be stipitate owing to the fact that the new shoots do not arise from the last node but from one lower on the rhizome.

S. 535, Dulit ridge c. 1350 m., 20th September, 1932, P. M. Synge. "Flowers pale brownish yellow, column brighter yellow. Slight bitter scent."

Described from dried plants.

Bulbophyllum (§ Aphanobulbon) densissimum sp. nov.

Pseudobulbi c. 5 cm. dissiti, cylindrici, breves, 1-folii. Folium oblongum, apici conduplicatum obtusum, longe petiolatum petiolo basi vagina magna tubulosa celato. Inflorescentiæ e basi pseudobulbi, densissime multifloræ. Bracteæ lanceolatæ, acutæ. Sepala petalaque carnosa, dimidio inferiore papillosa, sepala caudata. Sepalum dorsale oblongum, longe acutatum. Sepala lateralia triangulari-oblonga, margine antico basi leviter dilatato. Petala valde falcata, subulata, acutissima. Labellum manifeste 3-lobum, bicarinatum carina minore interposita, lobis lateralibus rotundatis, lobo intermedio subulato obtuso.

Rhizome stout, creeping, covered with the remains of old sheaths, very densely rooting, c. .70 cm. diam., internodes c. .60 cm. long. Pseudobulbs c. 5 cm. distant, longer than broad, cylindric, wrinkled, at first concealed by rather fleshy

sheaths, c. 1.15 cm. tall, c. .60 cm. wide when dry, 1-leaved. Leaf oblong, apex conduplicate and obtuse, fleshy, coriaceous, grooved above, keeled beneath, c. 24 cm. long, c. 6.50 cm. wide, base narrowed gradually to a grooved petiole c. 14 cm. long the base of which is concealed within some large loose tubular fleshy sheaths up to c. 7 cm. long. Inflorescences erect from within the sheaths at the base of the pseudobulb, very densely many-flowered, peduncle stout with c. 3 tubular sheaths at the base and 4 loose larger ones at intervals above c. 18 cm. long, rachis nodding 10 cm. or more long. Bracts much longer than the pedicel and ovary, lanceolate, acute, c. .75 cm. long. Sepals and petals fleshy, papillose in the lower half. Dorsal sepal oblong, long acutate for c. .35 cm, 3-nerved, c. 1.10 cm. long, c. .17 cm. wide. Lateral sepals triangular-oblong caudate for c. .42 cm., 3-nerved, falcate, c. 1.25 cm. long, c. .25 cm, wide at the base. Petals strongly falcate, subulate, very acute, 1-nerved, margins minutely erose in the lower half, c. .70 cm. long, c. .10 cm. wide. Lip 3-lobed, provided inside with 2 papillose keels which rise at the margins at the base of the side lobes converge and join about the middle of the midlobe, elevate above the base into a transversely oblong papillose cushion which is produced at the apex to a short median keel, spread out c. .30 cm. long, c. .16 cm. wide across the side lobes, sidelobes broadly rounded with the margins minutely denticulate, midlobe recurved subulate obtuse convex fleshy with the margins minutely serrate-denticulate c. .17 cm. long. Column including the porrect straight subulate stelidia c. .27 cm. long, stelidia c. .13 cm. long; foot scarcely free, strongly incurved above the middle, oblong, c. .18 cm. long, calli at base O. Pollinia 4 in 2 pairs, the inner of each pair rudimentary triangular, the outer roundly triangular and flattened inside.

The nearest ally of this plant appears to be *B. macrophyllum* Krzl., also a Sarawak species, but it differs from that plant according to the description in the smaller leaves, shorter inflorescence with comparatively longer peduncle and very dense rachis of much larger flowers. Both species

have comparatively large petals.

S. 98, Dulit c. 2000 feet above camp, 4th August, 1932, native collector. "Tree near trail in upper limits of rain forest. Flowers creamy. Smell slight and sweet. Red scale leaves (? sheaths) on flower stem."

Described from dried material.

Bulbophyllum (§ Aphanobulbon) grandilabre sp. nov.

Pseudobulbi c. .60 cm. dissiti, 1-folii. Folium oblongooblanceolatum, obtusum, breviter petiolatum. Inflorescentiæ e basi pseudobulbi, gracillimæ, 1-floræ (? semper). Bractea ovata, acuta. Sepalum dorsale oblongum, acutum. Sepala lateralia latissime ovata, acuminata, sigmoidea. Petala lanceolata, subacuta, dimidio superiore minute papillosa marginibus ciliolatis. Labellum pro sectione magnum, oblongo-lanceolatum, acuminatum, obtusum vel inconspicue emarginatum, basi carinis brevissimis papillosis 2 donatum, marginibus basi excepta ciliatis. Pes gynostemii egibbosus.

Pseudobulbs c. .60 cm. distant, disc-like, covered with fibres of old sheaths, c. .15 cm. tall and as broad, 1-leaved. Leaf oblong-lanceolate, obtuse, coriaceous, grooved above, keeled beneath, c. 2.40 cm. long, c. .50 cm. wide, base twisted and narrowed to a grooved petiole c. .45 cm. long which is almost entirely hidden by a large sheath. Inflorescences erect from the base of the pseudobulb as long as the leaf (? or longer), 1-flowered (? always), peduncle very slender provided at the base with some tubular sheaths and c. 2 longer tubular sheaths at intervals in the lower half c. 3 Bracts ovate, acute, c. .30 cm. long. cm. long. sepal oblong, acute, 3-nerved, c. .65 cm. long, c. .23 cm. Lateral sepals very broadly ovate, acuminate, subacute, sigmoidly curved, anterior margin incurved near the apex, 3-nerved, c. .60 cm. long and as broad. Petals lanceolate, subacute, minutely papillose in the upper half with ciliate margins, 1-nerved, c. .40 cm. long, c. .10 cm. wide. Lip relatively very large for the section, entire, oblonglanceolate, acuminate, obtuse or inconspicuously emarginate, nerves 3 inconspicuously elevate in the dried flower, papillose towards the apex, provided inside above the base with 2 short papillose keels, margins ciliate except at the base, spread out c. .63 cm. long, c. .32 cm. wide. Column including the very short subulate stelidia c. .17 cm. long; foot linear, strongly incurved towards the very shortly free apex, callus at base O, c. .50 cm. long.

This is a very distinct species characterized by the 1-flowered (? always) inflorescence, the comparatively large flower with very broad lateral sepals and the large ciliate lip with 2 short basal keels. Unfortunately the material consists only of a portion of a rhizome c. 1.10 cm. long with 2 pseudobulbs, a single leaf and inflorescence.

S. 135, Dulit c. 500 m., 8th August, 1932, P. M. Synge. "Flowers yellow, borne singly, cream. No scent."

Described from the dried plant.

Cirrhopetalum mastersianum Rolfe in Lindenia VI (1890), 33. t. 255.

S. 134, Dulit c. 500 m., 8th August, 1932, P. M. Synge. "Stem reddish. Labellum yellow. Two side petals small, brown, post petals (lateral sepals) united, large, orange-

brown in colour. No scent." The material consists of a portion of an inflorescence alone.

Distribution:—Endemic.

*Cirrhopetalum linearifolium Ridl. in Journ. Linn. Soc. XXXII (1896), 283; Bulbophyllum stenophyllum Ridl. Mat. I (1907), 83.

2659, Marudi forest reserve under 300 m., November, 1932, native collector. "Epiphyte near the ground, 'heath' forest. Flowers creamy yellow marked with dark crimson."

Distribution:-Malay Peninsula.

Cirrhopetalum rhombifolium sp. nov.

Pseudobulbi approximati, ovoidei, plus minusve quadrilaterales, 1-folii. Folium rhombeo-ellipticum vel rhombeo-lanceolatum, obtusum, interdum mucronulatum, tenue. Inflorescentiæ e basi pseudobulbi, 2-floræ, quam folia multo breviores. Bracteæ ovato-lanceolatæ, acuminatæ, acutæ. Sepalum dorsale oblongum, apicem versus in acuminem gracilem longum abrupte angustatum. Sepala lateralia basi torta excepta omnino connata, lanceolata, longe caudata, margine antico basin versus rotundatim dilatato. Petala falcata, anguste triangularia, acuminata, obtusa, minute mucronata. Labellum carnosum, anguste ligulatum, rotundatim recurvum, supra sulcatum.

Pseudobulbs approximate to 1.20 cm. distant, ovoid, more or less 4-sided with concave sides, up to c. 1.90 cm. long, c. .90 cm. diam., 1-leaved. Leaf rhombeo-elliptic or rhombeo-lanceolate, obtuse, sometimes with a minute mucro, thin in texture, keeled beneath, up to c. 10.50 cm. long, c. 2.40 cm. wide, petiole grooved up to c. 1.20 cm. long. Inflorescence from the base of the pseudobulb, much shorter than the leaves, 2-flowered, peduncle clothed at the base with some short imbricating sheaths c. 6.25 cm. long, rachis thickened and flattened c. .30 cm. long. Bracts ovatelanceolate, acuminate, acute, c. .65 cm. long. Flowers glabrous. Dorsal sepal oblong, abruptly narrowed to an acumen c. .35 cm. long, cucullately convex outside below the acumen, 5-nerved, in all c. 1-10 cm. long, c. .37 cm. wide. Lateral sepals except near the twisted falcate base connate for the whole length, lanceolate, long caudate with the caudate part grooved above and very acute, very fleshy, 3nerved at the base with the lateral nerves branched, c. 6.10 cm. long, c. .55 cm. wide. Petals falcate, narrowly triangular, acuminate, obtuse with a minute mucro, keeled outside towards the apex, 3-nerved, c. .47 cm. long, c. .24 cm. wide at the base. Lip fleshy, narrowly ligulate, obtuse, roundly curved, margins produced at the base to a short

rounded lobe, above grooved almost to the apex highly convex above the middle, beneath provided with a tall grooved keel, not spread out c. .30 cm. long, c. .17 cm. wide. Column c. .30 cm. tall, margin of clinandrium minutely denticulate, stigma oblong with a large rounded cushion beneath; foot c. .55 cm. long, apex ending in 2 divaricate papillose lobules.

This plant is a near ally of *C. biflorum* J. J. S., a native of Java, Borneo and possibly the Malay Peninsula. It differs, however, in the shorter not clavate acumen of the dorsal sepal, the very much narrower petals with obtuse apex only very minutely mucronate and in the lateral sepals the apex of which is very acute and slender not at all broadened.

2362, Dulit under 300 m., 30th October, 1932, P. W. Richards.

Described from a dried plant and a flower preserved in spirit.

Cymbidium Finlaysonianum Lndl. Gen. & Sp. Orch. (1833), 164. etc.

S. 40, Marudi near sea level, 27th July, 1932, *P. M. Synge*. "Sepals yellowish green with red stripe. Labellum pinkish. Pollinia yellow. Scentless."

Distribution:—Sumatra, Java, Malay Peninsula, Celebes, Sula Is., Philippines.

Bromheadia brevifolia Ridl. in Journ. Linn. Soc. Bot. XXXII (1896), 340.

S. 540, Ulu Koyan c. 850 m., 22nd September, 1932, native collector. "Flowers pinkish-magenta on outside, labellum magenta inside. Side petals cream. Column magenta at base."

Distribution:—Malay Peninsula.

Oxyanthera micrantha Brongn. in Dup., Voy. Cog. (1834), 198, t. 37 B. etc.: *Thelasis micrantha J. J. S. in Fl. Buit. VI* (1905), 495, Atlas f. CCCLXXIV. etc.

S. 349, Dulit c. 1500 feet alt., 27th August, 1932, native collector. "Flowers very pale orange on outside, white inside."

Distribution:—Sumatra, Java, Malay Peninsula, Philippines.

*Phreatia listrophora Ridl. in Journ. Linn. Soc. Bot. XXXII (1896) 307.

S. 533, Ulu Koyan c. 950 m., 19th September, 1932, native collector. "Flowers pale pink. No scent."

Distribution: -- Malay Peninsula.

Thecostele alata Par. & Rchb. f. in Trans. Linn. Soc. XXX (1874), 135, 144, t. 29. etc.

S. 632, Niah under 300 m., November, 1932, P. M. "Petals and labellum pale yellow with crimson streaks and blotches. No scent."

Distribution: - Sumatra, Java, Malay Peninsula, India,

Philippines.

Acriopsis javanica Reinw. Fl. Lit. II (1825), 4. etc. S. 58, Dulit 2nd August, 1932, P. M. Synge. "Petals white with broad magenta stripe. Labellum white with

magenta stripes".

S. 439, Dulit ridge c. 1230 m., 6th September, 1932, P. M. Synge. "Flowers pale green. Labellum brown." The leaves of this are small and fleshy but I can find no difference in the structure of the flowers.

Distribution:—Sumatra, Java, Malay Peninsula, Celebes, Moluccas, Tenasserim, Philippines.

*Thrixspermum acuminatissimum Rchb. f. Xen. Orch. II (1867), 121. etc.

S. 45, Marudi near sea level, 27th July, 1932, P. M. Synge.

Distribution:—Sumatra, Java, Malay Peninsula,

Philippines.

Sarcochilus indusiatus comb. nov. S. stenoglottis Hook. f. Fl. Brit. Ind. VI (1890), 34. Thrixspermum indusiatum Rchb. f. in Gard. Chron. (1886), i, 585.

S. 385, Dulit under 300 m., 2nd September, 1932, P. M. Synge. "Flowers creamy white, labellum dead white. Two faint purple streaks at base of lateral petals. scent."

Distribution:-Sumatra, Malay Peninsula.

Sarcochilus membraniferus sp. nov.

Caulis 15 cm. longus vel longior, validus, foliosus. Folia lineari-oblanceolata, oblique subacuta, crasse carnosa, basi in forma petioli angustata. Inflorescentiæ ad 3 superpositæ, breves, c. 4-floræ, rachide facie floræ in membranas 2 tenues valde elevata. Bracteæ late triangulari-ovatæ, subacutæ. Flores simultanei. Sepalum dorsale ovato-ellipticum, obtusum, tubercula conica extus sub apice. Sepala lateralia late ovata, obtusa, falcata, extus apicem versus breviter sed conspicue carinata. Petala oblonga, obtusa. Labellum mobile, brevissime unguiculatum, 3-lobum, calcaratum, carnosum, lobis lateralibus cuneatis obtusissimis, lobo intermidio minuto tuberculiformi basi in lobulos 2 falcatos subulatos quam lobos laterales multo breviores instructo, calcare carnosissimo supra carinato.

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Stem up to 15 cm. long or more, stout, leafy, rooting at intervals, c. .50 cm. diam., internodes up to 1.15 cm. long. Leaves c. 11 together, linear-oblanceolate, obliquely subacute, thickly fleshy, narrowed in the form of a petiole and concave at the base, up to c. 11.50 cm. long, c. 1.50 cm. wide, sheaths tubular fleshy. Inflorescences up to 3 superposed from the base of the internodes behind the leaves, short, c. 4-flowered, peduncle rather flattened elliptic in section up to c. 2.30 cm. long with an ovate bract-like sheath at the base and another below the middle, rachis up to c. 3.30 cm. long the internodes dilate above each flower into 2 parallel tall thin half lanceolate membranes which taper upwards and are up to c. .25 cm. tall above the base. Bracts broadly triangular-ovate, subacute, embracing the base of the membranes of the rachis, keeled on the back, c. .35 cm. long, c. .83 cm. wide. Flowers open together, sepals and petals very fleshy. Dorsal sepal ovate-elliptic, obtuse, a conic tubercle outside below the apex, 5-nerved with the outer nerves branched above the base, c. 1.20 cm. long c. .58 cm. wide. Lateral sepals running to the apex of the column foot, broadly ovate, obtuse, falcate, a short conspicuous keel outside at the apex, 5-nerved with the outer nerves branched above the base, c. 1.20 cm. long, c. .80 cm. wide. Petals oblong, obtuse, 3-nerved with the outer nerves branched above the base, c. 1.05 cm. long, c. .38 cm. wide. Lip mobile on the apex of the column foot, shortly clawed, 3-lobed, spurred, minutely papillose, c. 1 cm. long to tip of spur, c. .88 cm. wide across the side lobes; side lobes cuneate or cuneately dilate from an oblong base, very obtuse, c. .33 cm. long, c. .20 cm. wide at the apex; midlobe represented by 2 falcate subulate lobules c. .17 cm. long a minute tubercle between; spur elongate-conic, narrowly obtuse, a little dilate beneath above the base thence flattened to the tip, conspicuously keeled above, entrance c. .08 cm. diam., walls very fleshy. Column curved, keeled on the back, c. .50 cm, long, rostellum produced to a subulate beak, foot forming about a right angle with the column straight dilate at the apex into 2 rather divergent rounded lobules c. .47 cm. long. Anther suborbicular, beak very short truncate. Pollinia 2, subpyriform, grooved nearly to the base, caudicle narrowly oblong a little narrowed about the middle c. .23 cm. long, disc ovate.

A distinct species characterized by the very fleshy leaves, short lax inflorescences, few flowers and by the tall membranes on the rachis.

S. 455, Dulit ridge c. 1230 m., 10th September, 1932, native collector. "Flowers pale orange, crimson ring at base of petals. Flower stalk has prominent light green sheath. Slight sweet scent. Aerial roots conspicuous."

Described from a dried plant.

Sarcochilus hirtulus Hook. f. Fl. Brit. Ind. VI (1890), 39.

S. 200, Dulit under 300 m., 15th August, 1932, *P. M. Synge*. "No scent. Labellum white. Hood yellow. Wings yellow spotted red, as also post petal."

Distribution:—Malay Peninsula.

Adenoncos triloba sp. nov.

Caulis e basi pendula ascendens, basi dense radicans, ramosus. Folia valde arcuata, linearia, pungentia, crasse carnosa, intus concava, extus alte convexa. Inflorescentiæ breves, 1-2-floræ. Bracteæ ovatæ, acutæ. Sepala oblonga, acuminata, acuta, lateralibus extus conico-apiculatis. Petala oblonga, obtusa. Labellum 3-lobum, intus dimidio inferiore super basin carina papillosa donatum, lobis lateralibus triangularibus truncatis, lobo intermedio breviter et late obovato, obtusissimo, subtruncato, apice brevissime apiculato-acuminato.

Stem ascending from a pendulous base, branched and densely rooting at the base, up to c. 16 cm. long, c. .20 cm. diam., internodes c. .25-.85 cm. long. Leaves strongly arched, linear, pungently apiculate, thickly fleshy, concave inside, highly convex keeled beneath, 1.10-4 cm. long, sheaths tubular ribbed and minutely transversely wrinkled. Inflorescences 1-2-flowered, peduncle minute, rachis c. .20 cm. long. Bracts ovate, acute, c. .15 cm. long. Dorsal sepal oblong, triangular-acuminate, acute, margins incurved towards the apex, 1-nerved, c. .30 cm. long, c. .15 cm. wide. Lateral sepals oblong, acute, keeled on the back and conicapiculate at the apex, c. .35 cm. long, c. .17 cm. wide. Petals oblong, obtuse, 1-nerved, c. .27 cm. long, c. .075 cm. wide. Lip 3-lobed fleshy, provided inside in the deeply concave lower half above the base with a papillose keel which reaches the base of the midlobe, spread out c. .52 cm. long, c. .35 cm. wide across the side lobes; side lobes erect, triangular, truncate; midlobe shortly and broadly obovate, very obtuse almost truncate, shortly bluntly apiculate-acuminate, inside deeply concave at the base. Column c. .16 cm. tall, rostellum triangular. Anther transversely elliptic, beak minute rounded.

This is apparently nearest to A. vivax J. J. S. from Sumatra from which it differs in the 2-flowered inflorescences and flowers with a different lip much broader across the side lobes than across the midlobe. From the Bornean

A. saccata J. J. S. it differs in the shorter fewer-flowered inflorescence, and the distinctly 3-lobed lip with different keel and no transverse constriction beneath.

S. 603, Niah under 300 m., November, 1932, P. M. Synge. "Flowers pale orange. Leaves fleshy, incurved and

semicircular in transverse section."

Described from dried plants. Trichoglottis cuneilabris sp. nov.

Caulis elongatus, foliosus. Folia anguste oblongoelliptica vel oblongo-lanceolata, apici obliqua obtusa, carnosa. Inflorescentiæ ad 4 superpositæ, brevissimæ, 1-3 floræ. Bracteæ brevissimæ, breviter et late ovatæ, subacutæ. Sepalum dorsale anguste elliptico-oblongum, obtusum. Sepala lateralia calcaris basi brevissime adnata, lanceolatooblonga, breviter acuta, obtusa, margine antico super basin rotundatim dilatato. Petala oblongo-oblanceolata, breviter acutata, obtusa. Labellum 3-lobum, calcaratum, fauce calcaris carinis 2 tortis trans lobos laterales productis et ibi pilosis donatum, calcare conico obtuso dorso complanato, lobis lateralibus usque ad medium gynostemii adnatis parte libera anguste triangulari acuminata acuta, lobo intermedio e basi angusta late cuneato-dilatato apici trilobulo lobulis exterioribus rotundatim triangularibus obtusis lobulo intermedio parvo semiorbiculari carinis 3 papillosis e basi usque ad medium fere donato. Gynostemium basi lamella oblonga truncata pilosa et ciliata usque ad apicem loborum lateralium vix attingente lobis lateralibus parallela donatum.

Stem elongate, rooting, branched, leafy, up to c. 19 cm. long, c. .30 cm. diam., internodes c. 2 cm. long. Leaves narrowly oblong-elliptic or oblong-lanceolate, oblique and obtuse, fleshy, grooved above, keeled beneath, base twisted and narrowed, sheath tubular ribbed. Inflorescences from the base of the internodes behind the leaves, up to 4 together, up to c. .80 cm. long, 1-3-flowered. Bracts, minute, shortly and broadly ovate, subacute c. .10 cm. long. Dorsal sepal narrowly elliptic-oblong, obtuse, 3-nerved c. 1.05 cm. long, c. .24 cm. wide. Lateral sepals very shortly adnate to the base of the spur, lanceolate-oblong, shortly acutate, obtuse, anterior margin roundly dilate above the base, subfalcate, 5-nerved, c. 1 cm. long, c. .35 cm. wide. oblong-lanceolate, shortly acutate, obtuse, minutely papillose especially towards the base, 3-nerved, c. .95 cm. long, c. .24 cm. wide. Lip 3-lobed, spurred, fleshy, c. .75 cm. long from tip of spur to apex of midlobe, c. .70 cm. wide across the side lobes; spur conic, obtuse, flattened on the back, provided at the entrance with 2 conspicuous diverging twisted keels which are produced across the side lobes as low hairy ridges and provided inside on the back with an

oblong truncate hairy lamella with ciliate margins which rises from the column, lies parallel to the side lobes and does not quite reach to their apex, c. .20 cm. long; side lobes adnate to the column about to the middle, the free part triangular subulate-acuminate acute c. .22 cm. long; midlobe very broadly cuneate from a very narrow base, apex 3-lobulate, the outer lobules large roundly triangular obtuse, the median lobule small semiorbicular, provided with 3 rounded papillose keels which are dilate upwards and reach from the base to about the middle. *Column* c. .40 cm. tall. arms subulate very short.

This is a near ally of *T. celebica* Rolfe with which it agrees well in habit and in the leaves. The flowers are however, quite distinct. In his description of *T. celebica* Rolfe did not mention the two very tall papillose keels on the blade of the midlobe which is deeply and subequally 3-lobed from about the middle. The lip is described as glabrous whereas I find it distinctly papillose.

2407, Gunong Balapan, Ulu Tinjar, c. 600-900 m., 2nd November, 1932, native collector. "Perianth yellow mottled with scarlet."

Trichoglottis Smithii nom. nov. T. quadricornuta J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. IX (1927) 188.

2637, Sungei Tru, Ulu Tinjar, under 300 m., 23rd November, 1932, native collector. "Perianth segments creamy white marked with orange-brown; labellum white with deep magenta spots."

A new name is necessary for this plant as the name *T. quadricornuta* is preoccupied by Kurz (Journ. As. Soc. Beng. XLV (1876), II, 156, t. XIII, f. 1-7).

Distribution:—Endemic.

Robiquetia spathulata J. J. S. in Nat. Tijdschr. Ned. Ind. LXXII (1912) 115; Orch. Jav. Atlas. f. CDLVI. etc.

S. 624, Niah under 300 m., November, 1932, P. M. Synge. "Tree overhanging small stream. Petals reddish brown with white stripe in centre, spur creamy. Post petal hood-like. Slight sweet scent."

Distribution:-Sumatra, Java, Malay Peninsula, Molu-

ccas, Philippines, India.

Tæniophyllum (§ Brachyanthera) kapahense sp. nov.

Caulis brevis, dense radicans. Radices elongati, supra subtusque complanati. Inflorescentiæ breves, paucifloræ, glabræ. Bracteæ alternatim bifariæ, ovatæ, conicoapiculatæ, intus profunde concavæ. Sepalum dorsale elliptico-oblongum, obtusum. Sepala lateralia basi calcaris labelli breviter adnata, e basi brevissime unguiculata ovata,

obtusa. Petala falcata, lineari-oblonga, obtusa. Labellum integrum, calcaratum, oblique quadratum, obtusum, valde concavum, calcare e basi angusta ovoideo obtuso quam laminam longiore. Gynostemium breve, latum, brachiis

stigmatis brevibus rotundatis, rostello ovato bifido.

Stem short, very densely rooting, c. .50 cm. long. Roots elongate, flattened above and beneath, narrowly elliptic in transverse section, c. 9 cm. long, c. .20 cm. wide, c. .10 cm. thick, appressed to the substratum. Inflorescences short, few-flowered, glabrous, peduncle c. .25 cm. long, rachis forming an obtuse angle with the peduncle flexuous c. .40 cm. long. Bracts alternate, ovate conspicuously conicapiculate beneath, deeply concave within. Sepals and petals glabrous. Dorsal sepal elliptic-oblong, obtuse, 1-nerved, c. .20 cm. long, c. .08 cm. wide. Lateral sepals shortly adnate to the base of the spur, very shortly clawed, blade ovate obtuse, keeled on the back, 1-nerved, c. .20 cm, long, c. .10 cm. wide. Petals falcate, linear-oblong, obtuse, 1-nerved, c. .20 cm. long, c. .05 cm. wide. Lip entire. spurred, blade obliquely subquadrate obtuse the lateral angles erect rounded deeply concave inside c. .20 cm. long c. .23 cm. wide, spur narrowed at the base ovoid obtuse above c. .25 cm. long. Column c. .12 cm. tall and as broad, stigmatic lobes short rounded, rostellum ovate shortly bifid. Anther transversely oblong, narrowed in front to an oblong truncate or very inconspicuously retuse convex beak.

Kapah without number:

Described from spirit material.

Tæniophyllum affine Schltr. in Fedde Repert. IX (1911), 294.

S. 187, Dulit under 300 m., 13th August, 1932, *P. M. Synge*. "Flowers minute, whitish yellow. Leaves (roots) green, straplike."

Distribution:—Endemic.

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ADDITIONS AND CORRECTIONS TO RIDLEY'S FLORA OF THE MALAY PENINSULA.

By E. D. Merrill, Director, New York Botanical Garden.

The following notes were prepared in connection with the identification of several important recent collections of Sumatra plants; as in connection with any general work on the flora of Sumatra it is essential to take into consideration the standard publications appertaining to the flora of the Malay Peninsula. The additions to the list of known Malay Peninsula species are, with one exception, in the nature of introduced and naturalized plants. The corrections involve some new binomials where Mr. Ridley used preoccupied specific names, and one substitution of an older name than the one used by him.

CHLORIS SWARTZ.

Chloris tenera (Presl) Scribn. in Rept. Missouri Bot. Garden 10: 41. pl. 40. f. 2. 1899; Merr. in Bull. Soc. Bot. France 73: 28. 1926.

Cynodon tener Presl Rel. Hænk. 1: 291. 1830.

Chloris obtusifolia Balansa in Morot, Journ. de Bot. 4: 166. 1890.

 Chloris ridleyi Hack. in Oester. Zeitschr. 52: 237. 1902.
 Eustachys obtusifolia A. Camus in Lecomte Fl. Gén. Indo-Chine 7: 541 1923.

Chloris ridleyi Hack. was based on a specimen collected by Ridley in Pahang, and there is a specimen of this collection in the Kew Herbarium. It is therefore rather strange that Ridley should have overlooked the species in the preparation of his treatment of the Gramineæ in his Flora of the Malay Peninsula (1925). This distinctly characteristic species is now known from Sumatra, Malay Peninsula (Pahang), Indo-China, Hainan, Philippines (Luzon, Negros, Bohol), Celebes, Gilolo, Amboina, and New Guinea.

ARISTOLOCHIA TOURNEFORT.

Attention is called to a curious error in Ridley's treatment of *Aristolochia tagala* Cham., Fl. Malay. Penin. 3: 17. 1924 (excl. f. 136.). The description correctly calls for cordate leaves, but the illustration represents a species remote from Chamisso's species, a form with non-cordate leaves, and a species not described among the four admitted

by Ridley. I suspect that Ridley's figure 136 erroneously named Aristolochia tagala actually to represent A. indica Linn., a species not recorded from the Malay Peninsula but one that possibly occurs there in cultivation.

CLEOME LINNAEUS.

Cleome ciliata Schum, & Thonn, in Dansk, Vid. Selskabs, Skriften 4: 67, 1827 (Beskr. Guin. Plant. 294, 1827); Oliv. Fl. Trop. Afr. 1: 78. 1868.

Cleome guineensis Hook. Niger Fl. 218. 1849. Penang, Haniff 331, December 1928, Singapore, Clemens 22514, November 1929. Of comparatively recent introduction and naturalization here as it is in Java and Sumatra. Native of tropical Africa.

MEMECYLON LINNAEUS.

Memecylon perakense nom. nov.

Memecylon gracilipes Ridl. in Journ. Straits Branch Roy. As. Soc. 79: 72. 1918, Fl. Malay Penin. 1: 811.

1922, non C. B. Robinson 1911.

A new name is manifestly needed for the Malay Peninsula form described by Ridley because of his oversight of Robinson's previous use of the same specific name for a very different Philippine species.

RUELLIA PLUMIER.

Ruellia tuberosa Linn. Sp. Pl. 635, 1753.

Singapore, along streets, Clemens, November, 1929. Introduced from tropical America and more or less naturalized in several places in the Peninsula as it now is in parts of India, Sumatra, Borneo, and Java.

IXORA LINNAEUS.

Ixora ridleyi nom. nov.

Ixora crassifolia Ridl. in Journ. Straits Branch Roy. As. Soc. 79: 83. 1918, Fl. Malay Penin. 2: 98. 1923, non Merr. 1910.

A new name is needed here because of my use of crassifolia for a Philippine species eight years before Ridley's species was described.

BORRERIA G. F. MEYER.

Borreria lævis (Lam.) Griseb. Fl. Brit. West Ind. 1: 349. 1861; Backer & Van Sloot Jay. Theeonkr. 205. f. 205. 1924.

Spermacoce laevis Lam. Tabl. Encycl. 1: 273. 1791.

Singapore, Changi, Clemens 22512, November 1929, on the seashore. Malay Peninsula, without locality, Lim Boon Keng. Recently introduced and naturalized here as it is in Java, Sumatra, Philippines (Jolo), New Britain, New Guinea (Sepik Ririu), and Samoa. Native of tropical America where it is widely distributed.

PENTAPHRAGMA WALLICH.

Pentaphragma ellipticum Poulsen in Kjæb. Vid. Med. Nat. Foren. Kobenh. 321 pl. 4-5. 1903.

Pentaphragma ridleyi King & Gamble in Journ. As. Soc. Beng. 74(2): 57. 1905 (Mater. Fl. Malay. Penin. 4: 267. 1905); Ridl. Fl. Malay Penin. 2: 202. 1923.

Poulsen's publication antedates that of King and Camble by two years, and his excellent description and illustration clearly shows that *Pentaphragma ellipticum* Poulsen is identical with *P. ridleyi* King & Gamble.

ELEURANTHERA POITEAU.

Eleuranthera ruderalis (Sw.) Schulz.-Bip. in Bot. Zeit. 24: 239. 1806.

Melampodium ruderale Sw. Fl. Ind. Occ. 1372. 1806. Singapore, Clemens 22570, November, 1929, in waste places. Introduced and naturalized here as it is in Java and Sumatra. The genus is not included in Ridley's Flora of the Malay Peninsula.



A NECTRIA PARASITIC ON A LIVERWORT: WITH FURTHER NOTES ON NEOTIELLA CROZALSIANA

By E. J. H. Corner, Botanic Gardens, Singapore.

In Pahang, four years ago, when scanning with a lens a gingerleaf covered with liverworts, I descried upon a certain species the tiniest red fruit-bodies. returning to Singapore I collected as many leaves with the liverwort as possible and keeping them alive in the laboratory for a few days I drew up this account of a new species of Nectria. It resembled so closely the discomycete, Neotiella crozalsiana, that I determined to compare them, the more particularly as doubts had been expressed on my interpretation of that species, whether it were not truly a pyrenomycete. In England, in 1933, I collected fresh material of N. crozalsiana, from the wood where I discovered it, and having checked my previous account I reaffirm its correctness and may now, with a bryophilous pyrenomycete for comparison, vindicate my standpoint. I have for distribution abundant dried material of both species and a little of *N. crozalsiana* in formalinalcohol. To Dr. Fr. Verdoorn, of Leiden, I am indebted for the identification of the liverwort.

Nectria (Dialonectria) egens n. sp.

Mycelium superficiale, ex hyphis hyalinis separatis, non Mycelium superficiale, ex hyphis hyalinis separatis, non contextis, reticulato-ramosis, haud raro in ramis brevibus inter se conjunctis, $2.5-4\mu$ latis, in valleculis inter parietes convexos superficiales cellularum foliorum et stipitum hospitalium appressis, compositum: hypharum cellulæ $6-20\mu$ longæ, membranis $1-1.5\mu$ crassis, quæque hyphopodio uno, parvo, subgloboso, subsessili, tenuiter tunicato, $3-4\mu$ longo x $2-3\mu$ lato, præditæ. Perithecia $95-150\mu$ alta, $65-105\mu$ lata, sparsa, solitaria vel raro bina, amphigena ad folia hospitis marginem versus disposita.

disposita, minutissima, pyriformia, ostiolata, glabra, tenera, aurantio-rubra, collo brevi plus minus distincto $20-34\mu$ longo x $18-25\mu$ lato prædita. Paries perithecii $12-20\mu$ crassus, dense plectenchymaticus, hyphis contiguis, e stratis duobus compositus: strato externo 1—2 cellulas crasso, luminibus cellularum 5—12 x 1—3 μ , ex hyphis crasse tunicatis pigmento plus minus deficientibus contexto: strato interno 2—3 cellulas crasso, luminibus cellularum 6—14 x 4— 10μ , ex hyphis tenuiter tunicatis granulis aurantiacis plenis contexto. Periphyses numerosi, in collum projicientes, haud emergentes, e cellula una aut cellulis duobus granulis aurantiacis plenis compositi: cellulæ terminales periphysium inferiorum cylindricæ, $12-16 \times 3-4\mu$; periphysium superiorum minores $6-8 \times 10^{-10}$ 2-3.5_u, pigmentoque plus minus deficientes. Paraphyses nulli.

Asci 40-46 x 9-10 u, 8-sporati, subventricosi, apicibus obtusis. tenuiter tunicati, inoperculati, ostiolo simplici iodo non

cœrulescenti dehiscentes.

Sporæ 8—9.5 x 3.5—4u, irregulariter instructæ, albae, hyalinae, ellipsoideae, leves, tenuiter tunicatæ, intus nebulosæ, guttis

duobus raro singulis hyalinis aut leniter flavidis, 2—2.5 μ latis præditæ, tandem saepe septum transversum plus minus medium inter guttas duas deponentes sed haud vel leniter ad septum constringentes.

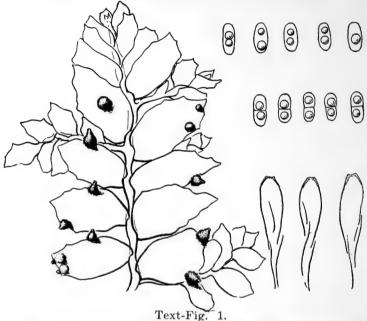
Conidia non visa.

Hab. in foliis stipitibusque Leptolejeuneae corynephorae (Nees) Schiffn., ad folia zingiberis crescentis, parasitica, in silvis paludosis prope Tembeling, Pahang, peninsulæ malayanæ, Nov—Dec. 1930.

malayanæ, Nov—Dec. 1930.

Species habitu, mycelio parasitico sparso superficiali hyphopodiato atque peritheciis glabris solitariis valde distincta:

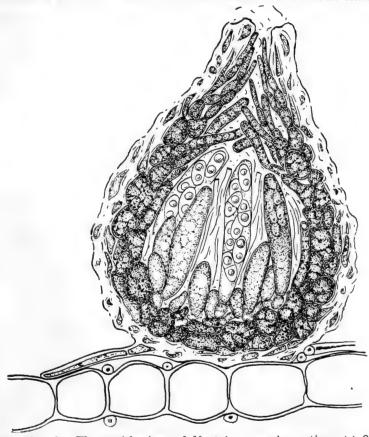
forma sporarum N. episphaeriae (Tode) similis.



Leptolejeunea corynephora with the perithecia of Nectria egens, \times ca. 50: ascospores and apices of dehisced asci of N. egens, \times 1000.

The living hyphæ are applied to the host so closely that unstained they are invisible, the perithecia appearing unattached. Saffranine, eosine and iodine are ineffective but cotton-blue stains the protoplasm intensely by which means the hyphæ can be traced. They have a habit which distinguishes them at once from those of moulds and stray spores which sprout in profusion in the felt of liverworts. They lie in the grooves between the outer convex walls of the cells of the liverwort, in most cases singly, and at the corners of the host-cells, over the junctions of their anticlinal walls, each hyphal cell bears a hyphopodium, Text-Fig. 3. The mycelium, on stem and leaves, has the form of a network with hyphopodia at the nodes, and almost every intercellular groove may be occupied. The hyphæ rarely traverse the face of the host-cells: they never grow

into the air vegetatively: and I did not succeed in detaching them. At the edge of a leaf they follow round the grooves to the other side and they progress from leaf to leaf along the stem. They may reach young leaves which are halfgrown but they do not penetrate the growing-point, and they die off from old leaves which are browning. There are no haustoria and the cells of the host suffer no obvious harm.

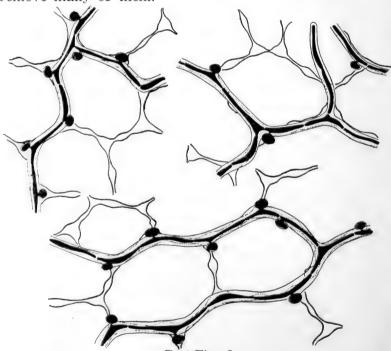


Text-Fig. 2. The perithecium of Nectria egens in section: \times 800. The perithecium originates from a short hypha which projects $10-20\mu$ from the leaf. A few laterals from the hypha interweave contiguously to form a knot which then differentiates into the two layers of the perithecial wall. The outer hyphæ of the knot become thick-walled with colourless lumen; the inner hyphæ remain thin-walled and acquire an abundance of carotin in the form of granules and droplets. The knot enlarges by the branching of the internal hyphae, by the growth of the ascogenous hyphae and by the elongation of the cells of the outer layer. It remains globose until some 60μ wide when the neck is

formed. The internal tissue in expanding presses upon the external layer and forces it out as the neck on the side away from the leaf: this weakened area probably corresponds with the apex of the primordium opposite the original hypha over which the laterals merely closed by arching and interweaving of their extremities, the remainder of the wall being compounded of the body of the hyphæ. But the external layer does not give way until the perithecium is full-sized, when the ostiole appears in the neck by rupture or dissolution. The neck is not formed by apical growth after the ostiole. Air-spaces are absent and the perithecium, in spite of its thick-walled outer layer, is soft and easily crushed under the weight of a coverslip.

Two or three short hyphæ grow from the base of the perithecium as a rudimentary mycelium and by adhering to the leaf may attach it the more securely. They are narrow, thick-walled, $2.5-4\mu$ wide, up to 40μ long, and consist of one or two cells containing a little orange pigment, and with simple obtuse ends. But the perithecia are easily dislodged—by the lightest touch of a needle—and as they often develop at the edge of a leaf, poised even on a leaftooth, it is a wonder they do not tumble off; rain must

remove many of them.



Text-Fig. 3. Hyphæ of N. egens above the cells of the leaf of L. corynephora: the hyphæ stained with cotton-blue, the shrunken protoplasm being shown black: hyphopodia at the junctions of the anticlinal walls; × 800.

It seems that the asci are feeble and discharge their spores with little vigour so that they barely escape the ostiole. I placed coverslips over patches of the liverwort with fresh perithecia, hoping that some would be directed towards them, but no spores arrived even when scarcely .5 mm. away and left for 2—3 days. Neither do the spores emerge in tendrils nor collect in a powder round the neck, though some may be seen at times just within the ostiole of freshly mounted perithecia.

Some ginger-leaves were dried for 2—4 days and then moistened: the liverwort turned brown and did not revive but the perithecia seemed healthy. When dried for 7—8 days and then moistened the perithecia also discoloured. But being unable to observe spore-discharge I could not determine the resistance of the perithecia to desiccation.

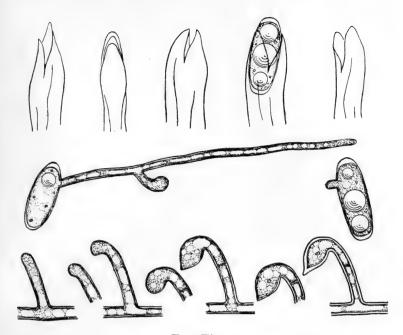
The fungus is a parasite because it does not grow on the surrounding ginger-leaf or on other species of liverworts or lichens on the same leaves and it is intimately connected with its host. Its source of food is not, however, Were there haustoria they would stain with cotton-blue and in all probability would have some visible effect on the cells of the host, but while dead cells do occur in the leaves of the liverwort they have no connection with the Nectria and generally contain the very narrow hyphæ The hyphæ must tap the flow of food in those parts of the cellulose walls which are immediately beneath the surface of the liverwort, and with their hyphopodia. These organs, which are borne regularly over the junctions of the anticlinal walls, are like the hyphæ very closely pressed to the surface of the host and they seem to be thin-walled over the part which is in contact. All the food which passes from the leaves into the stem and whatsoever flows in the opposite direction must traverse the anticlinal walls of the leaves and the only barrier between the hyphopodia and this flow of food is exceedingly thin cuticle. It cannot be more difficult to extract food from a liverwort this way than it is for a lichen-hypha to extract food from a thick-walled gonidium: and the alternative that in the grooves on the liverwort collects some matter to the special liking of the fungus is improbable. The curious distribution of the perithecia follows also the parasitic habit. The perithecia develop only on the leaves and mostly on distal halves which are the areas photosynthesis because the cells of the leaves have many more chloroplasts than those of the stem and the distal halves of the leaves are better illuminated as they do not overlap.

The fungus does not interfere with the growth of its host. Infected plants, dotted with perithecia, bore numerous sporogonia in all stages of development and they appeared as large and vigorous as uninfected plants. At most it is a weak parasite as one would expect from its powers of attack.

SYSTEMATIC POSITION

At the instance of Neotiella crozalsiana, the affinity of specialised, reduced ascomycetes cannot be inferred directly from the form of the ascocarp. In this case, however, the fungus is certainly a pyrenomycete and the perithecium a normal body. The asci are inoperculate and though this is a property of inoperculate discomycetes few of them possess carotin, and the structure and texture of the perithecium, the form of the spores and the absence of paraphyses are typical of Nectria. Several Nectriæ are bryophilous but none of the bryophilous Inoperculeæ, or indeed any genus of the family, has any close connection with N. egens. The other bryophilous Nectriæ, e.g. N. muscivora (B. et Br.) v. Hæhn., Calonectria Brongniartii (Cr.) Sacc., C. duplicella (Nvl.) Karst., and Pseudonectria Metzgeriae v. Hœhn., have larger perithecia seated on a white floccose subiculum, representing a less degraded state of the stroma, and larger spores than N. egens, which in its minuteness and meagre mycelium is the most depauperate: in general appearance and spore-characters it approaches N. episphaeria. Yet in one respect it seems aberrant. The asci of N. egens discharge through a distinct, if immarginate, foramen. In Nectria typically, according to Tulasne, de Bary and Pethybridge, though there seem to have been no exact observations in recent years, the walls of the asci deliquesce at maturity and the mass of spores liberated inside the perithecium is squeezed through the ostiole in a slimy tendril. But to what extent are these bryophilous species really cogeneric with other Nectriæ which may be saprophytes or parasites of most diverse order preferring stems, leaves or fruits, ferns, fungi, algæ, lichens or even This large group of such uniform construction appears but formally classified at present at levels of convergence and without regard for sequence of environment or or biological trend. Not merely as Fusaria do they appeal for physiological enquiry.

The hyphopodia resemble those of such Perisporiaceæ as Balladyna or the appressoria of Erysiphaceæ. The intracellular haustorium may have evolved from such a rudiment.



Text-Fig. 4.

Neotiella crozalsiana: apices of dehisced asci, germinating spores, and stages in the development of the haustorial branch: \times 500.

NEOTIELLA CROZALSIANA Grelet

A few details may be added to my previous account, c.f. Text-Fig. 4. The asci dehisce through a bilabiate slit which is generally more or less median and longitudinal but which is occasionally so oblique as to appear as an elongate Several germinating spores were found on the leaves lid. of the host. A single germ-tube arises near one end of the spore and as it grows the oil-drops in the spore dwindle and disintegrate. When the germ-tube is about 100μ long, the first cell is cut off near the spore and from this cell a haustorial branch grows out: as in mildews and other ectoparasites the germ-tube sinks a haustorium at the first opportunity. The haustorial branch is formed by apical growth and acropetal thickening of the wall. It starts obliquely forward, in the direction of the apex of the parent hypha, for a distance of $10-50\mu$, then by unilateral expansion it turns sharply at right angles towards the parent hypha: the apex dilates into the body of the appressorium and contracts again into the beak. The wall thickens more rapidly and extensively on the exposed parts and hence it seems that the thin-walled expansion which

becomes the appressorium is turned inward by the more rapid hardening of the outer side: this arrangement will also press it firmly to the leaf. Several infected host-plants had healthy young sporogonia.

COMPARISON OF NECTRIA EGENS AND NEOTIFILLA CROZALSIANA

Both fungi are bryophilous with a superficial mycelium upon which the ascocarps are scattered singly without stroma or tapesium. The ascocarp is a perithecium with an ostiole, periphyses, a mucilage-cavity and a wall which is similarly differentiated in each into two layers, the hyphæ of the inner layer containing carotin. They differ this way:—

- 1. The hyphæ of *N. crozalsiana* boldly traverse the surface of the host with free ærial ramifications and they bear elaborate intracellular haustoria composed of 1—2 cells: those of *N. egens* are confined within the intercellular grooves and bear minute sessile hyphopodia without haustoria, the hyphopodia being appendages of the hyphæ not branches.
- 2. The ascocarp of N. crozalsiana is hairy, that of N. egens glabrous.
- 3. The ostiole in N. crozalsiana is bounded by a palisade of clavate hyphal ends, which is lacking from N. egens.
- 4. The paraphyses of N. crozalsiana contain carotin at least in the proximal cells: paraphyses are lacking from N. egens.
- 5. The ascus of N. crozalsiana is 5-times longer and 3-times broader than in N. egens: it opens by slit in N. crozalsiana and a pore in N. egens.
- 6. The spores of *N. crozalsiana* are four or five times longer and broader than those of *N. egens* and they are triguttate and continuous: those of *N. egens* are biguttate and uniseptate.
- 7. The asci of N. crozalsiana discharge the spores forcibly for a distance of 3 cm. or more: those of N. egens are so feeble that the spores barely clear the ostiole and do not travel a distance of even one millimetre.

In points 2—7 *N. crozalsiana* is an operculate discomycete and *N. egens* a pyrenomycete. In the Operculeæ a secondary mycelium always develops copiously from the base of the ascocarp, with which part the fruit-body of

N. crozalsiana is homologous, but rarely or scantily from the perithecia of pyrenomycetes: in a reduced operculate discomycete one would therefore expect a hairy ascocarp but not necessarily in a pyrenomycete. The margin of the apothecium in the Operculeæ is nearly always determinate from a greater or less amount of marginal growth, but in pyrenomycetes marginal growth from the ostiole appears exceptional. On account of the mechanical and constructional function of the paraphyses in apothecia, they are especially characteristic of discomycetes and always persist to maturity: in pyrenomycetes they are commonly lacking or are diffluent and disappear at maturity, and they are absent from most Nectriæ. Wide asci and wide spores characterise the Operculeæ, narrow asci and narrow spores the Nectriæ. Generally in the Operculeæ the asci have a transverse or slightly oblique lid, though in some typical Aleuriæ and Pezizeæ, as Phillipsia and Cookeina according to Bedijn, it is so oblique as almost to be a slit, and it is a longitudinal slit in Boudierella and Ascozonus; a slit rather than a lid may be related to the large size of the spores or projectile. In all the Operculeæ the asci dehisce with great vigour: in the Nectriæ they dehisce either very feebly or liberate the spores by dissolution of the walls. if it still can be argued that N. crozalsiana is a pyrenomycete, either it belongs in the Hypocreales in which case the first point must be considered whether in the same family two bryophilous pyrenomycetes could have evolved with such radically different modes of parasitism and spore-dispersal, c.f. the uniformity of the Erysiphales and Uredinales, or it represents an unknown order. My interpretation of the fruit-body, as a persistently juvenile form of cleistocarpic apothecium, clearly stands the test and with the abundance of information which it supplies concerning the evolution of the ascocarp it seems also the most natural. Given, in fact, a cleistocarpic apothecium maturing at so early a stage, it could but be perithecioid. The resemblance between N. crozalsiana and N. egens is one of convergence, enhanced by their reduced and simplified construction, and I do not doubt that Nectriella Lophocoleae Massal. is another such humariaceous discomycete, if it is not indeed the same species as N. crozalsiana.

As for the general relation of fungi to bryophytes, whether a phylum of such primitive repute supports a fungus-flora of a primitive stamp, there is yet insufficient knowledge to declare, but if, as in this case, the fungi are degenerate that opinion of the Bryophyta must also be revised.

SUMMARY

Nectria (Dialonectria) egens, found in Malaya, is described as a new species parasitic on the liverwort Leptolejeunea corynephora. It is ectoparasitic with the hyphæ in the grooves between the convex superficial walls of the host. Haustoria are absent but food appears to be absorbed from the host through hyphopodia placed over the anticlinal walls. The asci dehisce feebly through an immarginate pore.

Supplementary details are given on the dehiscence of the ascus, the germination of the spores and the development of the haustorial branch in $Neotiella\ crozalsiana$. My former account of $N.\ crozalsiana$ is confirmed and a comparison with the true pyrenomycete, $N.\ egens$, supports the contention that the perithecioid fruit-body of $N.\ crozalsiana$ is but a persistently juvenile form of cleistocarpic operculate apothecium.

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ARACEAE MALESICAE

By C. X. Furtado, Botanic Gardens, Singapore

In this paper five new species are described, viz: Cryptocoryne Nurii, Pothos borneensis, P. kinabaluensis, Raphidophora kinabaluensis and Schismatoglottis retinervia. Of these only the first mentioned is from the Malay Peninsula, the rest being from Borneo; and of these latter, three are endemic on the Kinabalu Mountains, while the fourth is recorded also from Sarawak. Three new names are proposed because the species in question were published under already preoccupied names: Homalomena lunduensis (H. multinervia Ridl. of 1907, not H. multinervia Ridl. of 1902), Pothos Ridleyanus (P. ellipticus Ridl., not Moon ex Miquel), and Raphidophora Rosenburghii (R. crassifolia v.A.v.R., not of Hook. f.). Twelve species are reduced: Cryptocoryne grandis Ridl. (=C. cordata Griff.), C. pontederiifolia Schott sensu Ridl. (=C. johorensis Engl.), Pothos ovatifolius Engl. (=P. Rumphii Schott), Raphidophora Burkilliana Ridl. (=R. Maingayi Hk. f.), R. conocephala v.A.v.R., R. crassifolia Hk. f., R. nigrescens Ridl. and R. Wrayi Hk. f. (=R. silvestris Engl.), R. lancifolia Schott (=R. calophyllum Schott), R. Schottii Hk. f. (=R. hongkongensis Schott), Scindapsus hederaceus Schott sensu Merrill (=S. pictus Hassk.) and S. longisitipitatus Merr. (=S. perakensis Hk. f.). R. peepla (Roxb.) Schott is redefined and all misconsceptions that had gradually developed concerning this species have been eliminated. These reductions or redefinitions of the species have in some cases resulted in extending the distribution range, which in other cases has become restricted. A notable example of this restriction is R. peepla, which was regarded to occur wild in a very extensive region from India, Ceylon, Indochina, Borneo to Moluccas (cf. Engler et Krause in *Pflanzenr*. Hft. 37, 1908 p. 41; Ridley in *Journ. Linn. Soc. XLII* 1914, p. 171; Merrill, *Enum. Bornean Pl.* 1921, p. 89). Actually the species is known only from a small region in Assam (ie. Silhet) and appears to be very rare since it has not been collected again for the last one hundred years. The only specimens yet existing are those collected by Fernandez (Wallich's plant collector), Roxburgh's collections having been lost unless we assume that Wallich used Roxburgh's material to make his numbered sets. The other material that went by the name of R. peepla has been shown to belong to 5 distinct species exclusive of the Moluccan material which I have not seen and which may prove to be R. Storckiana Schott. Pothos Rumphii Schott which was known formerly only from the Philippines, Moluccas, Celebes and New

Guinea (cf. Merrill, Enum. Phillip Pl. I, 1922, p. 173) and recently from Sumatra (cf. v. Ald. v. Rosenburgh, in Bull. Jard. Bot. Buitz. IV, 1922, p. 337) has been recorded here from Borneo and Pulau Tioman, an island off the east coast of the Malay Peninsula.

The Key given by Engler and Krause in the *Pflanzenreich* Hft. 37 (1908) for the indentification of the *Raphidophora* species having undivided or unperforated leaves has been found to be unsatisfactory since its main divisions are made on the basis of the length of the leaves. This criterion is apt to mislead one to regard specimens of the one and the same species having different length as belonging to different species. Hence a *Key* calculated to lead to more natural and less confusing main groups has been suggested (*vide* observ. under *R. silvestris*).

My thanks are due to the Director of the Royal Botanic Gardens, Kew, the Director of the Botanical Gardens and Museum, Berlin-Dahlem and to the Keeper of British Museum (Botany), London, for providing me facilities to work in their respective herbaria and for permission to consult the herbarium collections under their charge.

The specimens cited are from the Singapore herbarium except when otherwise stated.

Cryptocoryne cordata Griff. Not. III (1851) 138 et. Ic. Pl. Asiat.III (1851) t. 172; Engl. Arac. Exsicc. et Illustr. no. 6; Hook f. Flor. Brit. Ind. VI (1893) 493; Ridl. Mat. Flor. Mal. Pen. III (1907) 4; Engl. Pflanzenr. IV. 23. F.=73 (1920) 242; Merr. Enum. Born. Pl. (1921) 108; Ridl. Flor. Mal. Pen. V (1925) 86.

C. grandis Ridl. in Journ. Roy. As. Soc. Str. Br. 44 (1905) 170; Engl. Pflanzenr. IV. 23. F.=73 (1920) 243; Merr. Enum. Born. Pl. (1921) 108. syn. nov.

I cannot find any difference between the typical C. cordata and Ridley's C. grandis. Burn-Murdoch's specimen, for instance, collected on Bukit Tapis in Pahang (comm. sub. n. 213) matches exactly with the type of C. grandis (Sarawak, leg. Haviland, n. 2319, in Herb. Sing.) not only as regards the length of the leaves and of the spathes but even as to the structure of the spadix and the venation of the leaves and Burn-Murdoch's specimen is clearly C. cordata. No doubt most of the specimens of this species preserved in various herbaria have much smaller leaves with much shorter petioles but such variations are dependent in this species not only on the age of the plant but also upon the depth of water in which they grow. Assuming that some of the smaller forms are specifically distinct from the larger ones, a new name should then

be given to the smaller ones, for Griffith's species as represented by his plate and specimens is a larger form.

2. Cryptocoryne johorensis Engl. in Engl. Pflanzenr. IV. 23 F=73~(1920)~244.

C. pontederiifolia Schott sensu Ridley Mat. Flor. Mal. Pen. III (1907) 5 et Flor. Mal. Pen. V (1925) 8 f. syn. nov.

MALAY PENINSULA: Johore, between Gunong Pulai and Johore Bahru (Mat. comm. Ridley sub n. 3721. Type in Singapore, isotype in Kew); Track to Gunong Pulai (Ridley, 12, 141 in Singapore, Kew and British Museum).

Apparently Engler had not seen Ridley's Materials (op cit., 1907) for he makes the following observation on this species: "Hæc species ex herbario Singaporense sub nomine C. pontederiifolio distributa est, at ab ea, cujus spatha incognita est, differt foliorum lamina minore atque minute denticulata." Nor does it appear that Ridley had consulted Engler's monograph on Cryptocoryne when preparing the Malayan material for his Flora (op cit, 1925), for he has entirely omitted Engler's species in it.

3. Cryptocoryne (§ Bitubulosæ) Nurii Furtado spec. nov. Affinis C. Walkeri Schott ut videtur, sed folio crassiore et majore, basi cuneato, (haud abrupte contracto), petiolo crassiore, spathæ limbo latiore, explanato (haud torto), differt. A C. Wightii Schott folio breviore sed latiore, spathæ limbo latiore et cordato recedit.

Rhizoma circ. 5 mm. crassum. Foliorum petiolus circ. 17 cm longus, ad 3–9 cm longitudinis vaginatus; lamina elliptico-lanceolata, utrinque cuneata, basi sensim in petiolum transiens, apice acuta, 10–18 cm. longa, 3 cm. lata, supra viridis, subtus pallidior, margine crispata vel crispatulata, nervis primariis lateralibus utrinsecus 3–4, infra medium a costa abeuntibus, oblique adscendentibus, superioribus apicem versus arcuatim convergentibus, omnibus pagina superiore obscuris. Pedunculus circ. 7–12 cm longus, 2–3 mm in diam. Spathae tubus inflorescentiam includens 2–2.5 cm longus, circ. 0.5 cm in diam.; superior tubo inferiore angustior, 5.5–12 cm. longus, circ. 0.3 cm in diam.; limbus in vivo atro-purpureus ut videtur, cordatus, apice caudato-acuminatus, cum cauda 1.5 cm longa 4–5 cm altus, basi 1.5 cm –2.5 cm latus. Inflorescentia foeminea 3 mm longa, a mascula aequilinga laxiflora intersitio nudo, tenuissimo, 1 cm longo sejuncta. Pistilla fertilia 5, stilis quam flores rudimentarii duplo longioribus.

MALAY PENINSULA: Johore at Sungei Pelepah (Nur, 20038. Type in Herb. Singapore and Kew).

C. Walkeri and C. Wightii are the only other Cryptoryne species which have so long a peduncle to the inflorescence. In C. Walkeri the leaves are much smaller, thinner in texture and abruptly contracted at the base.

The limb of its spathes is twisted and not cordate. *C. Wightii* has much narrower and elongate leaves with crispate-undulate margins, and spathes terminating in a much narrower, not cordate limb. In leaves the species appears very much like *C. ciliata* (Roxb.) Fisch. which belongs to the *Section Ciliatae* Engl. and which has also very much longer petioles to the leaves.

4. Homalomena (§ Euhomalomena) lunduensis Furtado, nom. nov.

H. multinervia Ridl, in Journ. Roy. As. Soc. Str. Br. XLIX (1907) 49; Merr. Enum. Born. Pl. (1921) 95. [non H. multinervia Ridl, in Journ. Bot. XL (1902) 36.]

BORNEO: Sarawak, Lundu (Ridley in Sept. 1905, Type in Singapore).

The binomial *H. multinervia* Ridl. is preoccupied for a species belonging to the section *Chamaecladon* and hitherto known only from Mount Ophir in Malacca.

5. Pothos (§ Allopothos, ser. Longevaginati) borneensis Furtado spec. nov.

Affinis Pothoi Kingio Hk. f., sed folio majore, valide inæquilatero, nervis collectivis folii pluribus, nonnullis supra mediam orientibus, spadice spathæ æquilongo, pistillis apicem versus subito attenuatis in stigma sensim transientibus (haud truncatis vertice stigmate conoideo abrupte instructis) recedit. Folia eis Pothois Rumphii Schott sat similia, sed a hac specie spatha latiore basi decurrente, pistillo oblongo subito angustato (haud truncato) ex tepalis valde exserto differt.

Scandens. Rami infra-axillares, internodiis ad 4 cm longis et 1 cm crassis. Petiolus ad circ. 25 longus, ad geniculum 8 mm longum usque late vaginatus, vagina in ochream (=auriculas) circ. 8 cm longam (longas) producta. Lamina petiolo $1\frac{1}{2}$ -plo longior, valide inaequilatera, altero latere alterius ½ latitudine aequante, elliptico-oblanceolata, maxima latitudine supra mediam sita, utrinque attenuata, apice subito acuminata, basi obtusa vel cordulata, circ. 35 cm longa, 10-12 cm lata, nervis collectivis pluribus, apicem versus margini arcuatim approximatis, intimis plerumque supra mediam a costa abeuntibus, lateralibus primariis quam tertiarii validioribus, Pedunculi gemini, 7-9 cm longi, 3-4 mm crassi, in axiliis cataphyllorum nascentes, cataphyllis circ. 9 cm longis, apice in caudam filiformem circ. 2 cm longam contractis. Spatha reflexa, concavato oblongo-vel ovatolanceolata, apice abrupte cuspidata, stipite spadicis decurrens, pars libera circ. 4-6 cm longa, 3 cm lata, in vivo lutea ut videtur. Spadix ad 2 cm stipitatus, stipite spathæ fere omnino adnato, cylindricus, spathæ æquilongus vel ea paullo longior vel brevior, 4–6 cm longus, 1–1.8 cm in diam., fructiferus major. *Stamina* 6, tepalis æquilonga, circ. 2–2.5 mm longa. *Pistillum* oblongum, apicem versus subito attenuatum, summo stigmate sessile coronatum, ex involucro tepalorum exsertum. circ. 4 mm longum. *Bacca* ovata, sæpe trisperma, ad 1 cm. longa, 0.5–6 cm. crassa.

BORNEO: Sarawak: Limbang (Hewitt in July 1905. Type in Kew and Singapore); Bidi (Brooks, in February 1908 quoad inflorescentia). Kinabalu Mts, near Dallas, alt. circ. 3000 ft. (Clemens, 26542).

The Kinabalu specimen has somewhat smaller and comparatively broader leaves and shows signs that they are taken from a vigorous growing shoot, but the flowering material is very meagre to say whether it represents a distinct form.

6. Pothos (§ Allopothos, ser. Longevaginati) kinabaluensis Furtado spec. nov.

Species ex affinitate Pothois insignis Engl. et P. lancifolii Hk. fil., ab illa spadice non stipitato atque a hac folio multo majore cum nervis collectivis utrinsecus 3, petiolo longiore, vagina latiore facile distinguitur. Folia eis Pothois insignis Engl. valde similia.

Scandens. Rami infra-axillares, internodiis ad 8 cm longis, 0.5 cm crassis, ramulorum tenuioribus. Petiolus 10-18 cm longus, fere ad geniculum 1-1.5 cm longum usque late vaginatus, vagina apice paullo auriculata. Lamina petiolo æquilonga vel eo paullo longior, inæquilatera, altero latere alterius 3/4 latitudine æquante, ovato-oblonga, basi rotundata, ima obtusa vel cordulata, apice subito vel sensim longe acuminata, cum acumine 1.5-2 cm longo 15-23 cm longa, 5–10 cm lata, nervis lateralibus primariis pluribus, utrinque æquicrassis, angulo 60° a costa mediana abeuntibus, nervis collectivis utrinsecus 3-4, intimo interdum super mediam laminæ partem oriente, a margine 0.8-2 cm remoto, duobus exterioribus margini approximatis. Pedunculus solitarius vel geminus, ex axilla folii lamina destituti (=cataphylli) nascens, 8-15 cm longus, 2-3 mm crassus, in vivo fusco-purpurascens. Spatha coriacea, lanceolata, basi amplectens, apice acuta vel caudato acuminata, circ. 6-8 cm longa, 1.5 cm lata in vivo purpurascens. Spadix sessilis, cylindricus, apicem versus attenuatus, quam spatha sat brevior, 5-7 cm longus, ad 0.5 cm in diam., in vivo purpureus. Tepala 2 mm longa, subæqualia. Stamina 6, tepalis fere æquilonga, linearia. Ovarium tepalo æquilongum, urceolatum, apice truncatum, dilatatum, stimagte orbiculare sessili in centro instructo. Baccae immaturæ tantum visæ, ovatæ vel ovato-oblongæ, 1 cm longæ, 0.5 cm crassæ. Semen solitarium.

BRITISH NORTH BORNEO: Kinabalu Mts. at Tenompok, alt. circ. 5,000 ft. (leg. Furtado, comm. Clemens sub. n. 29,155. Type in Singapore); *ibid.* (Clemens, n. 28,514).

7. Pothos (§ Allopothos, ser Longevaginati) Ridleyanus

Furtado, nom. nov.

**P. ellipticus Ridley sp. nov. in Journ, Roy. As. Soc. Str. Br. XLI (1903) 48, Mat. Flor. Mal. Pen III (1907) 50 et Flor, Mal. Pen. V (1925) 129. [non P. ellipticus Moon ex Miq. Flor. Ind. Bot. III (1859?) 182 et in Berl. Bot. Zeitg. (1856) 562, from Ceylon].

MALAY PENINSULA: Pahang: Kuala Tembeling on the Pahang river (Ridley, in Aug. 1891. Syntype); Pulau Tawar (Ridley in Aug. 1891. Syntype); Kota Glanggi (Henderson, 22,411). Lower Siam, Bukit (Keah, 24,267).

8. Pothos Rumphii Schott Melet I (1832) 21; Engl. Pflanzenr. IV. 23B (1905) 38 f. 16; Merr. Enum. Philipp Pl. I (1922) 173 pro parte.

Pothos ovatifolius Engl. in Pflanzenr. IV 23B (1905)

40; Merr, Enum. Philipp Pl. I (1922) 173, syn nov.

I do not find any difference between these two except the form of the leaves, and these too show such a great amount of variation as to render the separation of the species on the leaf-shape impossible. In many aroids the adult leaves growing nearer the ground are shorter and more ovate and cordate than the ones more remote. I suspect therefore that *P. ovatifolius* Engl. represents the forms of *P. Rumphii* Schott growing nearer the ground.

The following extends the distribution range of the species:

BORNEO: Ben Kaian (Brooks in Sept. 1908).

MALAY PENINSULA: Pulau Tiuman, an island off the coast of the Pahang State, on rocks (Nur, 21,753).

The Bornean specimen has ovate leaves and the Peninsular has elongate ovate.

I have not seen the specimens of *P. ovatifolius* Engl. var *simalurensis* v. Ald v. Ros. from the Simalur Island off Sumatra. The author describes it as intermediate between *P. Rumphii* and *P. ovatifolius*.

9. Raphidophora calophyllum Schott in Bonpl. v. (1857) 45 nomen, et Prodr. (1860) 380; Engl. in DC. Monogr. Phan. II (1879) 242 status nov.

R. lancifolia Schott in Bonpl. V (1857) 45 nom. nud., Prodr. (1860) 380; Mast. in Gard. Chron. II (1874) 611 fig. 124; Engl. in DC. Monogr. Phan. II (1879) 241; Hook. f. Flor. Brit. Ind. VI (1893) 545; Engl. et. Krause in Engl. Pflanzenr. IV 23 B. (1908) 26. syn. nov.

R. peepla Schott Prodr. (1860) 380 quoad Icon. Hook. ined; Hook. fil. Flor. Brit. Ind. VI (1893) 545 exclus. Wight Icon. t. 780 et. Roxb. Icon. ined; Engl. et. Krause in Engl. Pflanzenr. IV 23-B (1908) 41 p.p. (non Pothos peepla Roxb). syn. nov.

R. Schottii Hook f. Flor. Brit. Ind. VI (1893) 544 quoad Icon. Hook. f. ined. syn. nov.

INDIA: The Khasia mountains and Manipur: (Watt. 5905; Griffith 5958; 5959; and 5960; Hooker and Thomson, 1431; 1023; 10052; Gamble, 9749; Clarke 5641, 16674; 26509).

BURMA: Pegu (Kurz. 2656).

R. lancifolia is nothing but immature or vigorous growing shoots of R. calophyllum having leaves with cuneate base and long acuminate apex. The leaves of such shoots usually appear membranous on drying. The above cited collections which excepting Hooker and Thomson no. 10052 are in Kew Herbarium show various transitions between this stage and the one described as R. calophyllum, and such variations may be noticed even on the same plant (cf. Griffith no. 5958). Watt no. 5905 cited by Hooker f., and Engler and Krause under R. lancifolia has leaves resembling in shape those described as R. calophyllum, but they are herbaceous as in R. lancifolia.

I have not seen specimens cited under R. peepla in Engler Pflanzenreich l.c. for Siam or Indo-China, except those referred by me to R. hongkongensis.

The species is apparently endemic in the mountainous regions of Assam and North Burma.

10. Raphidophora hongkongensis Schott in Bonpl. V (1857) 44, Prodr. 1860) 378, Engl. et. Krause in Engl. Pflanzenr. IV 23.B (1908) 35.

R. peepla Schott Prodr. (1860) 380 exclus. specimen silhetense et. Icon. Hook f. ined.; Benth. Flor. Hongkong (1860) 344 p.p.; Engl. et. Krause in Pflanzenr. IV 23.B (1908) 41 quoad specimina indochinensia infra citata. syn. nov.

R. Schottii Hook. f. Flor. Brit. VI (1893) 544 exclus. Icon. ined.; Engl. et. Krause in Pflanzenr. IV 23.B. (1908) 42. syn. nov.

INDIA: Assam (Masters, 127 in Kew Heab.); Khasia (Hooker. & Thomson in Kew Herb.). (Syntypes of R. Schottii.).

CHINA: Hongkong (Champion, 525. Sterile. Type of the species in Kew Herb.), (Lamont in 1874 in British Museum, sterile); Canton (MacClure, 9655 in Kew Herb.).

INDO-CHINA: (Pierre in Kew Herb.); Tonkin (Balansa, 2055 in Kew).

FORMOSA: (Price, 449, sterile in Kew)?

R. hongkongensis was based on a single leaf-specimen (a young detached leaf without any spathe or spadix) collected in Hongkong by Capt. Champion and submitted to Schott by Hooker fil. Better available material from the type region leaves no doubt that it is identical with the Indian material which was mistakenly referred to Pothos peepla Roxb., and later described by Hooker as R. Schottii. In their Clavis to the Raphidophora species, Engler and Krause (op. cit. p. 19) placed R. Schottii wrongly among the species having a petiole much longer than half the length of the lamina and this wrong disposition in the Key (the specific description is correct) is perhaps the reason why they failed to recognise in it K. hongkongensis. I have not seen Seemann's specimen quoted under the species by Schott in Prodr. (1860) 378, nor have I seen some of the specimens quoted by Engler & Krause l.c. under R. peepla from Siam and Indo-China. Hooker's unpublished drawing referred by Schott to R. peepla and by Hooker to R. Schottii is R. calophyllum Schott forma R. lancifolia.

Some specimens distributed from the Philippines under R. Perkinseae Engl. and acuminata Merr. approach very near this species.

11. Raphidophora kinabaluensis Furtado spec. nov.

R. peepla Schott sensu Ridley in Journ. Linn. Soc. XLII (1914) 171 et. Merrill Enum. Born. Pl. (1921) 89 quoad specimen kinabaluense (=Gibbsianum).

R. calophyllo Schott (=R. peepla auct.), quacum hæc species ab auctoribus ambobus supra citatis confusa est, valde affinis, sed lamina majore, basi haud rotundata, petiolo basin versus multum dilatato et late vaginato facile distinguenda. Foliorum indole etiam R. Forbesio Rendle et R. montanae Schott sat similis, sed recedit ab illa foliorum lamina oblong-elliptica vel oblong-lanceolata (haud elliptico obovata), pistillis apice truncatis, stigmate sessile coronatis (haud in stylum longiusculum productis), et ab hac spadice sessile (haud breviter stipitato) vagina petiolari latiore nonnibil infra (haud ad vel ultra) geniculum usque attigente.

Caudex carnosus, angulosus, circ. 1 cm. crassus, internodiis 2.5–5 cm longis. Foliorum petiolus laminæ æquilongus vel fere, interdum quam lamina longior, 15–30 cm. altus, basin versus valide, interdum abrupte, dilatatus, vagina nonnihil infra geniculum attingente late instructus, parte haud vaginata leviter canaliculata vaginatam interdum superante vel breviore, marginem vaginæ secus mox marcescens et laceratus. Lamina coriacea, oblongoelliptica vel oblongo-lanceolata, subæquilatera maxima

latitudine dimidio vel rarissime super mediam sita, basin versus sat attenuata, immo acuta vel obtusa, apice acuta vel sensim attenuata, acuminata, 18-35 cm longa, 6.5-15 cm lata, plurinervia, nervis primaris quam secundariæ vix validioribus. Pedunculus 10-12 cm longus, vaginis petiolorum partim tectus. Spatha 8-10 cm longa, in vivo flava. Spadix spathæ brevior, 3-6 cm longus, pistillis vertice truncatis, dilatatis, stigmate ovale vel oblongo sessile coronatis.

BRITISH NORTH BORNEO: Kinabalu Mts: Tenompok alt. circ. 4,500 ft. (leg. Furtado, comm. Clemens sub. n. 26875. Type in Singapore & London); Kamborangah, alt. circ. 6,000 ft. (leg. Furtado, comm. Clemens sub. n. 26713); Dallas, alt circ. 3,000 ft. (Clemens nos. 26121; 26243; 28142); Gurulau spur, alt. circ. 8,000 ft. (Gibbs, 4010 in Brit. Museum); ibid, alt. 6,000 ft. (Clemens, 51128); Penibukan, alt. circ. 5,000 ft. (Clemens, 31094).

It was abundant in open spaces and along bridle-paths at Tenompok. In such exposed situations ripe and unripe spadices could be easily obtained even from the plants trailing on the ground. It was not seen by me in dense or shady forests.

The leaves are very variable in size, both as regards the petiole as well as the lamina. In some cases the petiole may be nearly half the length of lamina, in other cases it is much longer than the lamina itself. In some cases the sheathed portion of the petiole may be longer than the unsheathed portion, in other cases it is much smaller, but in all cases the petiole is much dilated towards the base.

12. Raphidophora Maingayi Hook. fil. Flor. Brit. Ind. VI (1893) 543 Rid. Mat. Flor. Mal. Pen. III (1907) 43 et Flor. Mal. Pen. V (1925) 123; Engl. et Krause in Engl. Pflanzenr. IV 23. B=Hft. 37 (1908) 37. R. Burkilliana Ridl. Flor. Mal. Pen. V (1925) 121. syn. nov.

Malay Peninsula: Malacca [near Malacca town] (Maingay, 1556=2972. Type in Kew); Panchor (Goodenough 1926). Penang: Pulau Betong (Curtis, 2885, in Kew). Singapore: Bukit Panjang (Ridley in 1905); Chan Chu Kang (Goodenough, on December 20th, 1890); Bukit Timah (Ridley, in 1899). Selangor: Gua Batu=Batu Caves (Ridley in December 1896; Nur, 8965=Type of R. Burkilliana, in Kew and Singapore).

In Maingay's specimen (the type of *R. Maingayi*) a part of the petiole is cut off and it is therefore not possible to judge its length which, as judged from other specimens cited above, is equal to, or is often longer than, the half the length of the lamina. The other specimens from

Malacca, Penang and Singapore have leaves attenuate at base, while the specimens from Selangor have acute or abruptly acute leaf-bases.

Ridley mentions that R. Burkilliana has a shortly stipitate spadix. I had not paid a special attention to this point when making the comparison in the Kew herbarium, but the isotype specimen in Singapore has a sessile spadix, although it is fully developed and has in consequence shed its spathe. In fact were it not for the sessile spadices, all our Selangor specimens could have been easily confused with R. montana (Bl.) Schott as interpreted by Engler in his Exsicc. et Illustr. nos. 5a & 5b.

R. gracilipes Hook. fil. which, according to Ridley, is allied to R. Burkilliana Ridl. is a species belonging to a group having membranous, not coriaceous, leaves, with primary nerves very far apart, much stronger than the secondary ones, and very prominent on both the surfaces.

13. Raphidophora peepla (Roxb.) Schott in Bonpl. V (1857) 45; et Prodr. (380) p.p. (haud auctt.) (ex altera parte=R. hongkongensis Schott).

Pothos peepla Roxb. Flor. Ind. I (1820) 454 et (1832) 433; Wall. Cat. (1828) n. 4441.

Scindapsus peepla Schott Melet I (1832) 21; Wight Icon. III (1845) 5 t. 780.

Raphidophora Hookerii Schott Prodr. (1860) 361 quoad specimen silhetense; Engl. in DC. Monogr. Phan. II (1879) 243 p.p.; Hook. f. Flor. Brit. Ind. VI (1893) 546 p.p. (Wallich's n. 4441 is misprinted as 4444); Engl. et Krause in Engl. Pflanzenr. IV 23. B. (1908) 32 p.p. syn. nov.

INDIA: Silhet (Wall. exsicc. n. 4441 in Brit. Museum; in Herb. Kew partim.).

Roxburgh's plant came from Silhet and the drawing made by him as well as its lithographic copy issued by Wight in his Icones show leaves having distant primary nerves quite distinguishable from the secondary ones. Though the leaves in the drawing are quite young and small (a probable reason why the leaf-base is represented as unusually cuneate) the description says that they (the leaves) vary from 4 to 12 inches in length. It is not certain whether Wallich had seen Roxburgh's specimen, but Wallich's interpretation of *Pothos peepla* Roxb. as represented in his Exsicc. 4441 (apparently Wallich is not responsible for the mixture in the Kew herbarium) is certainly more in accordance with Roxburgh's drawing and description than the one given by any other systematist. R. calophyllum regarded by Hooker fil. and others as identical with P. peepla is a distinct and good species producing coriaceous, or sometimes herbaceous, leaves having primary nerves almost indisguishable from the secondary ones. The latter has not yet been recorded from Silhet.

R. peepla comes very near to R. Hookerii in the distant primary nervation and the texture of the leaves, but the latter species has not persistent cataphylls at the base of the peduncles or at the apex of the young shoots as in R. peepla, and has leaves which are usually crowded at the apex of branchlets and which are also very much larger having stouter nerves, often a cordate or subcordate base. Unlike R. peepla which has a lamina drying yellow or stramineous and petiole often longer than the lamina itself, R. Hookerii has a lamina drying dark brown and a petiole usually shorter than, rarely equalling, the length of the lamina. The nearest species to R. peepla is R. gracilipes Hook. f. from the Malay Peninsula which however is distinguished from the former by its very much shorter geniculum at the top of the petiole and smaller stigmata. Roxburgh's Icones do not show any long geniculum as in Wallich's 4441, and a sterile specimen apparently of R. peepla collected in Assam by Mann has a small geniculum as in R. gracilipes. More material from Assam and Malay Peninsula is necessary in order to study the exact relationship of these two species and to say whether R. gracilines deserves to be united with R. peepla.

The Ceylon plants referred by Thwaites (*Enum. Pl. Zeyl.*, 1864 p. 336) to *R. peepla* (*Scindapsus*) are *R. pertusa* Schott. As to the other interpretations of *R. peepla* see *R. calophyllum*, *R. hongkongensis*, *R. kinabaluensis* and

R. silvestris.

14. Raphidophora Rosenburghii Furtado nom. nov.

Epipremnum crassifolium Engl. in Pflanzenr. IV 23. B=37 (1908) 63 fig. 26.

Raphidophora crassifolia v.A.v.R. comb. nov. in Bull. Jard. Bot. Buitenz. I (1920) 382 (non R. crassifolia Hk. f. Flor. Brit. Ind. VI, 1893, p. 543).

Capt. van Alderwerelt van Rosenburgh, in whose honour the plant is named, was the first to show the fact that Engler's species was not an *Epipremnum* but a *Raphidophora*, but in making the transfer he overlooked the fact that the trivial name *crassifolia* had already been taken up by Hooker for another species of *Raphidophora* occurring in the Malay Peninsula (here reduced by me as a synonym of *R. silvestris* Engl.). The type of *R. Rosenburghii* is a specimen taken from a plant cultivated in the Botanic Gardens, Buitenzorg, of which a detailed diagnostic figure was given by Engler. It has not been collected since,

so that Capt. van Rosenburgh had not seen any specimen of this species in the Buitenzorg herbarium. Its native country is yet unknown.

15. Raphidophora silvestris (Bl.) Engl. in DC. Monogr. Phan. II (1879) 239; Engl et Krause in Engl. Pflanzenr. IV 23. B (1908) 22 fig. 6.

Calla sylvestris Bl. Catal. Buitenz. (1823) 62, Flor. (1825) 147.

R. conocephala v.A.v.R. in Bull. Jard. Bot. Buitenz. I (1920) 384 syn. nov.

R. crassifolia Hk. f. Flor. Brit. Ind. VI (1893) 543. (non R. crassifolia v.A.v.R.). syn. nov.

R. nigrescens Ridl. in Journ. Str. Br. Roy. As. Soc. 44 (1905) 185 syn. nov.

R. peepla Schott sensu Engl. et Krause in Engl. Pflanzenr. IV 23. B (1908) 41 quoad specimen borneense; Merrill Enum. Born. Plant (1921) 89 quoad specimina sarawakensia. syn. nov.

R. Wrayi Hook. f. Flor. Brit. Ind. VI (1893) 544, syn. nov.

This is very near to R. hongkongensis from which it differs in having its lamina more falcate and the petiolar geniculum sheathed or channelled as far as the base of the lamina or a little beyond. R. crassifolia is merely a vigorous growing form which does not show distinctly its nerves on drying. Between these two extremes there occur many gradations which formed the basis of the other The size of the leaves and spathes and the species. character of the leaf nervations do not offer a safe guide to differentiate these forms even into varieties as the characters depend on the age, position and vigour of the shoots. Sometimes it is possible to find various forms even on the same plant. Drying tends to make the leaves darkish whereas in R. hongkongensis they become brown, except the specimens from the young growth, which tend to become also blackish.

In Engler's Pflanzenreich the grouping or separation in Clavis of the species having undivided or unperforated leaves is not natural and is often apt to lead to confusion, as it is based on the size of the leaves. Had the criterion for separating the species been the texture and the venation of the leaves, a far better and more natural grouping of the species would have been obtained, viz.:—

A.—Primary nerves few, far apart, much stouter than the secondary ones, very prominent on both sides. Leaves membranous or herbaceous: eg. R. peepla, R. gracilipes, etc.

B.—Primary nerves few or almost inconspicuous above, slightly prominent beneath. Leaves coriaceous coriaceous. eg. R. Lobbii, R. Elmerii, etc. or

C.—Primary nerves many, hardly distinct from the secondary ones, slightly prominent or nearly inconspicuous in both surfaces. Leaves coriaceous or semi-coriaceous. eg. R. silvestris, R. Maingayi, R. montana, R. calophyllum,

This species has been collected also on the Kinabalu Mountains, up to an altitude of about 4,500 ft. (eg. Clemens comm. sub. nos. 26921, 29227 & 27312) but is not represented in Miss Gibbs's collection. Gibbs no. 4010 referred by various authors to R. peepla is R. kinabaluensis Furtado.

16. Schismatoglottis retinervia Furtado spec. nov.

Sch. patentinerviae Engl. affinis ut videtur, sed foliorum petiolo pro rata longiore, lamina minore, nervis primariis

paucioribus differt.

stoloniferus, ramis foliiferis erectis, Caudiculusbrevibus. *Petiolus* circ. 6—10 cm. longus ad mediam partem usque vaginatus. *Lamina* (sicca) atro-fusca, subtus pallidior, petiolo æquilonga vel brevior, ellipticooblonga vel elongato-ovata, utrinque attenuata vel basi rotundata, maxima latitudine dimidio vel infra mediam sita, 6-9 cm. longa, 2-4 cm. lata, margine frequenter undulata, nervis primariis utrinsecus 11—17 arcuatim patentibus, secundariis quam primariæ paullo gracilioribus, tertiariis tenuissimis, omnibus parallelis, reticulationibus subtus Pedunculus inflorescentiæ immaturæ tantum visus, circ. 3 cm. longus, vaginis foliorum obtectus, vix visibilis. Spatha circ. 3 cm. longa, lamina sine acumine 0.8 cm. longo tubo æquilonga. Inflorescentia foeminea tertiam spadicis 1.8 cm. longi partem æquans, a mascula fusiformi, dimidio superiore sterili, interstitio 3-4 mm. longo nudo vel floribus abortivis sparse obsito separata.

BRITISH NORTH BORNEO: Kinabalu Mts.: at Tenompok. alt. circ. 4,500 ft. (legit Furtado, comm. Clemens sub. no. 29153. Type in Herb. Singapore). By streams in dark jungles. Creeping aroid with white spathe and spadix.

The species is very peculiar not only because of its lateral nerves which are almost at right angles to the midrib of the leaf, but also because of the prominent reticulate venation in the lower surface of the leaves. All the parts become brown or dark brown on drying. Though there were many plants of this, it was not possible to get specimens with mature spadices.

17. Scindapsus perakensis Hook, fil. Flor. Brit. Ind. VI (1893) 543.

S. longistipitatus Merr. in Philipp. Journ. Sci. XXIX (1926) 353 syn. nov.

I have not come across any species of *Scindapsus* having persistent spathes and a stipel between the spathe and the spadix as long as 18—20 cm. as stated by Merrill. From an isotype specimen at Kew it is evident that Merrill's species is identical with *S. perakensis* Hook. f. The spathes, as usual, has fallen off and what Merrill describes as a persistent spathe is an axillant cataphyll (=leaf without lamina), and therefore his stipel is actually the peduncle of the inflorescence.

The species has been recorded also on the Kinabalu Mountains in British North Borneo, in the following places: Dallas, alt. circ. 3,000 ft. (Clemens, 26171 & 27719); Menerintog by the Masilau River, alt. circ. 6,000 ft. (leg. Furtado, comm. Clemens sub. n. 29181).

18. Scindapsus pictus Hassk. Cat. Hot. Bogor. (1844) 58.

S. hederaceus Schott sensu Merr. Enum. Philipp. Pl. I (1922) 178. syn. nov.

PHILIPPINES: Luzon (Catalan, 26436; Elmer, 15230; Ramos, 29233; 30383 & 15019).

It had been customary to regard S. argyraea Engl. as a juvenile form of S. pictus, but from Merrill's account (op. cit.) this view might appear to be erroneous since the type of S. argyraea is a Philippine plant and Merrill's account shows that S. pictus does not occur in the Philippines at all. But from the duplicates of the specimens quoted by Merrill under S. hederaceus and preserved in Kew and British Museum it appears that what Merrill calls S. hederaceus is really S. pictus, the former species not occurring at all in the Philippines. The pictus or argyraeus forms occur very frequently on the Kinabalu Mountains (Borneo) also, though adult forms are rather difficult to be obtained as they must grow vertically for some length in the sunshine before they can produce the adult stages with flowers and fruits. In virgin forests therefore these stages are found only on the tops of lofty trees.

♯ PALMAE MALESICAE

II. Nenga Wendlandiana Scheff. or Nenga pumila (Mart.) Wendl?

By C. X. Furtado, Botanic Gardens, Singapore

There seems to be some doubt which of these two names should be regarded as a synonym, and as the current usage and the authority of some specialists seem to clash with certain well-established nomenclatorial principles an inquiry into the question was undertaken and the results

are reported here.

In 1832 MARTIUS published in the Historia Naturalis Palmarum many new species of palms among which were Areca pumila (without author's name) and Areca nenga Bl. (4, pp. 177, 179). The first was fully described and contained an illustration of the plant from which Martius had worked out the description. Apparently the trivial name pumila was taken from Blume's manuscript notes or synoptic diagnosis which were supplied to him and which were also quoted in the synonymy of the species, for Martius had realised that there was some discrepancy between his diagnosis and the one supplied to him by Blume. The other species, Areca nenga, was one that Martius did not know and the name and the diagnosis were published as supplied by Blume.

In 1836 BLUME (2) published the second volume of his *Rumphia* where he tried to show that Martius had misinterpreted his manuscript species and that *Areca pumila* as described and illustrated by Martius was identical with the plant Blume had called *A. nenga* and which he (Blume) now fully described and illustrated under the newly created genus *Pinanga* as *P. nenga* (2, p. 78, t. 107). Blume further produced a full description and a plate of the plant to which he had intended to apply the name *A. pumila* and to which, according to him, the name should in future

be reserved (2, p. 71, tt. 99 & 102 C).

In 1848 (?) MARTIUS (5) published an Appendix to his Historia where he rejected the genus Pinanga of Blume, reduced Areca nenga Bl. apud Mart. and Pinanga nenga Bl. as synonyms of Areca pumila Mart. and made A. pumila Bl. (non Mart.) a variety of A. triandra Roxb. This disposition was generally accepted by subsequent botanists until the year 1871 when SCHEFFER (6, p. 166) produced reasons for accepting with minor restrictions the genera Areca and Pinanga as defined by Blume and also for keeping A. pumila Bl. (haud Mart.) as a species distinct from Areca triandra Roxb. Scheffer, be it noted, was not a strict subscriber to the priority principles and so he took A. pumila Bl. (haud Mart.) as a valid name for the palm

especially as A. pumila Mart, had another name in A. nenga Bl., a species retained by him under the genus *Arcca*. In 1875 WENDLAND and DRUDE (9, p. 182) conjointly published a new genus Nenga with Pinanga nenga Bl. as the type species, but omitted to make any new combination under it. In 1876 SCHEFFER (7, p. 25) supplied the name Nenga Wendlandiana for the species Pinanga nenga Bl. under the new genus apparently because the combination Nenga nenga was not permissible under the existing rules or usage. It is clear that he did not inquire into the matter whether or not Nenga pumila was admissible; in fact he does not quote A. pumila Mart, as a synonym of Nenga Wendlandiana, though he quotes other names which, according to him, are synonyms. In 1878 WENDLAND (8. p. 251), who strictly respected the priority rule, made a new combination of A. pumila Mart. (haud Blume) under Nenga, quoting Nenga Wendlandiana Scheff, as a synonym. In 1885 BECCARI (1, p. 83) opined that Wendland was wrong in making the combination because A. pumila Mart. (nec. Blume) was invalid being based on a misinterpretation of Blume's A. pumila; and in this opinion Beccari has been followed by many botanists. But as historically the Blumean interpretation came later than that of Martius, an inquiry into the exact status of Areca pumila in Martius's Historia seems to be necessary before accepting or rejecting any names or interpretations of the new species published in it

When Martius was working out palms for the Historia, Blume communicated to him descriptions of some new species to be published in it. These descriptions were often too short and vague to be of any use even to such an eminent palm specialist as Martius. When it was possible for Martius to identify Blume's (manuscript) species with the material in his own herbarium in Munich, he drew up the specific descriptions from this material only and, presumably, out of courtesy to Blume and perhaps with the view of helping palm students to identify Blume's manuscript names on the herbarium sheets, quoted Blume's manuscript names together with their insufficient or vague descriptions in the synonymy, adding in the citations Blume's localities and vernacular names which were supplied to him in letters. In such cases as these Martius apparently did not hesitate to reject Blume's trivial names if they described inadequately the species or if he had already provided names. Blume's Euterpe filamentosa was, for instance, rejected by Martius for what he described as Arcca nibung (4, p. 173). In other cases when Martius could not recognise Blume's (manuscript) species in the material he had, he published them at the end of the chapter

under each genus where he also listed all dubious and imperfectly known species. Here the Blumean species contained the names and diagnoses exactly as Blume had supplied them to Martius and were therefore published entirely under Blume's responsibility (e.g. Areca nenga Bl. and A. coronata Bl.). Hence it is apparent that Martius used discretion in adopting or rejecting a manuscript name obtained from Blume, save when it was impossible to connect Blume's description with any material in his own herbarium, and then courtesy constrained him to publish the species with Blume's indifferent or inadequate diagnoses. And what is still more easily noticeable in the *Historia* is that when Martius considered Blume's manuscript descriptions applicable to herbarium material to which he had access, he made this material the basis of his descriptions and illustrations, though in the synonymy and in particulars relating to the habitat or distribution and vernacular names information supplied by Blume was added perhaps, as pointed above, out of courtesy to Blume and to make his book more useful to the palm students of his time. In modern phraseology one can safely say that the type of the descriptions or the species was the material to which Martius had access and not the one which formed the basis of Blume's descriptions quoted in the synonymy.

In the *Historia* one can therefore distinguish at once between the species published on Martius's entire responsibility, even though bearing names suggested by Blume's notes, and the species published wholly on Blume's responsibility. Areca pumila falls into the former category. Here Martius may have adopted the name suggested by Blume's manuscript notes because it appeared to him suitable, but the diagnostic characters and detailed description were drawn entirely from the specimen Martius had seen and for which he supplied a good plate. That he adopted Blume's manuscript name and in deference quoted Blume's brief, vague and slightly variant manuscript diagnosis in the synonymy, and in addition quoted at the end of the description the vernacular name and the locality of Blume's plant, should not cloud the fact that Areca pumila was not a preoccupied name and that Martius had supplied full details and figures of the species to which this name, till then not preoccupied, should be applied. In view of this it is clear that Martius's publication and reservation of the name for the species are valid and that the species is at the most A. pumila Bl. mss. ex. Mart. exclusiv. synon. A. pumila Bl. in litt. if not simply A. pumila Mart., and that its type is not Blume's specimen which Martius had not seen, but Reinwardt's which he had studied and of which he had supplied full details and a plate. One cannot discard

the species because in adopting Blume's manuscript name Martius had misinterpreted the manuscript species, for the author of a new species is not bound to ascertain the type of an unpublished manuscript name in the case he wishes to adopt it (the mauscript name) for the species he wishes The publisher is free to choose his to describe as new. own type independently of that selected by the author of the manuscript name. Nor can one disregard Martius's species on the ground that is is a mixtum compositum, for apart from the citation of one specimen, there is nothing in Martius's description or in Blume's description quoted in the synonymy to suggest that it is such a case, and there is an excellent plate to illustrate Martius's type. If a precedent is allowed to eliminate Martius's species because it does not correspond with the alleged type of the manuscript species quoted in the synonymy, though the species itself is fully described and illustrated, then I fear a tremendous slaughter of well known names will be unavoidable and botanical nomenclature will have to bear an unnecessary burden of thousands of additional names coined to replace the discarded ones. Even well known Linnean names may disappear since Linnæus himself had very often tried to identify his species with the ones already described by other authors and so his synonymy is very often found to be a mixture of various species.

But what reasons has one to say that, at the time of supplying the information to Martius, Blume himself was not confused over his Areca pumila and A. nenga and to maintain that the interpretation given in Rumphia is the one that Blume had originally given when transmitting his communications to Martius? What does Blume mean by informing Martius that his Areca nenga has distichous fruits and later identifying it with A. pumila Mart.? palm with such characteristics can never be A. pumila Mart. or any other species of Nenga hitherto described. In fact Pinanga nenga Bl. is Areca nenga Bl. apud (or in) Mart. pro parte, since the description of the spadix is that of a genuine Pinanga as the genus is currently interpreted. Further as has already been noted by Martius (5, p. 312) Blume gives a figure in his plate showing a trilocular and triovulate ovary, though no mention of it is made in the text and in the generic description given by Blume only a one-locular and one-ovular ovary is indicated. The material from which this figure was drawn did not apparently belong to Blume's Pinanga nenga, unless Blume had with him some abnormal material.

A. pumila Mart. being valid it follows that A. pumila Bl. in Rumphia is invalid since it is not applied to the type of Martius. This means therefore that Nenga pumila

(Mart.) Wendl. is a valid combination having a better claim for usage over Nenga Wendlandiana Scheff. And that A. pumila Bl. in Rumphia requires a new name. This was found by me (3, p. 226) in the Areca latiloba Ridley, of which A. pumila Bl. is but a geographical form or a variety.

A note may here be added to show certain errors which have crept into botanical or horticultural literature concerning these two palms, Areca pumila Mart. A. pumila Bl., owing to the disregard by some botanists of the priority rule. In the Flores des Jardins II (1859), 145, t. 10. Siebold and De Vriese treat the two binominals as if they represent only one species, A. pumila Bl.=A. latiloba Ridl., as the synonymy quoted and the plate given clearly In Bailey's Standard Cyclopedia of Horticulture, (1917), the binominal A. pumila is quoted under Nenga Wendlandiana Scheff.=N. pumila Wendl. by two authors (N. Taylor and J. G. Smith) and in two places, but since in both these places the name of Blume is added after the binominal and since in one place the plate (Bot. Mag. t. 6025) of A. pumila Bl.=A. latiloba Ridl. is quoted in the synonymy of the Nenga species, it is evident that a mistake has been made in considering the two distinct plants A. latiloba Rild. and N. pumila Wendl., as only one species. In the Index Kewensis only the binominal published by Martius is recognized and Martius's plate is also cited, but Blume is regarded as the author of the species and so the homonym published by Blume in Rumphia has not been registered. In the Index Londinensis (1929) on the other hand, the illustrations of both A. pumila Mart. and of its homonym A. pumila Bl. are indexed under the first mentioned name.

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OBITUARY.

Walter Fox.

We regret to record the death, on July 23rd, 1934, at the age of 76, of Walter Fox, who was on the staff of the Gardens Department, Straits Settlements, from the year 1879 until 1910. Mr. Fox came originally to Singapore as Head Gardener, to assist H. J. Murton, who was then Superintendent. In 1889 Mr. Fox published a Guide to the Botanic Gardens, Singapore, which gives an interesting record of that period of the history of the Gardens. In 1903, on the retirement of Charles Curtis from Penang, Mr. Fox took charge of the Waterfall Gardens, and continued there until his retirement, from ill health, in 1910.

After retirement, Mr. Fox regained his health sufficiently to undertake journeys to South America and elsewhere for the purpose of reporting on rubber.

CORRIGENDA.

The Ferns of Mount Kinabalu, Gardens Bulletin, S. S., Vol. VII, part 3, June 1934.

p. 195, line 9, for "beyond Marei Parei, att. 5000 ft." read "in the Silau Basin, altitude about 6000 ft."

p. 214, line 35, for serrulatum read serratulum.

p. 215, line 7, for corrulatum read corratulum.

p. 324 (index) for Trichomanes serrulatum read

Notes on the Biology of Macaranga spy., Gardens' Bulletin, S. S., Vol. VIII, part 1, October 1934.

p. 63, line 22, for "specimens" read "species".

p. 63, line 36, for "indurated to accommodate" read. "too indurated to accommodate".

b. 64 line 20, for "(Plate XV, figs. 2, 3)" resid "(Plate XIV, figs. 5, and 6)".



THE

GARDENS BULLETIN

STRAITS SETTLEMENTS

Vol. VIII

24th June 1935

Part 3

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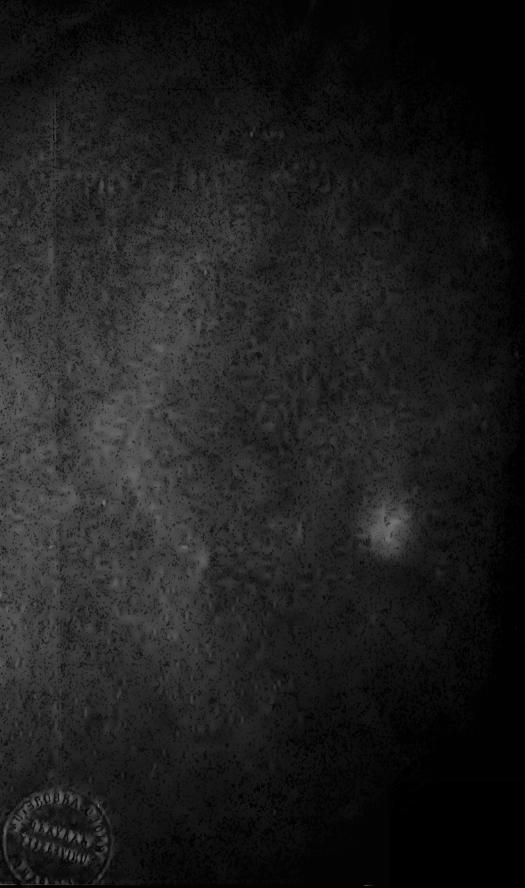
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Part 3

TWO COLLECTIONS OF ORCHIDS FROM BRITISH NORTH BORNEO, PART I

by C. E. Carr

EDITORIAL NOTE

This paper is the first of a proposed series on the collections of orchids made on Mount Kinabalu by Chaplain Joseph Clemens in 1931-1933 and by Mr. C. E. Carr in 1933. Mr. Carr's collections were made for the Botanic Gardens, Singapore, and the numbers cited are in the series of Singapore Field Numbers (SFN) which are used for all collections now distributed from the Singapore herbarium. Mr. Carr quotes also his own numbers, which are prefixed with the letter C. By arrangement with the Keeper of Botany, British Museum (Natural History), to whom due acknowledgement is made, Mr. Carr was enabled to study the Clemens collections together with his own, thus making the present record as complete as possible. The number of species involved is so large that it has been found desirable to publish the enumeration in a series of papers. The present paper covers the Apostasiaceæ and Orchidaceæ up to the genus Arundina.

In all, 137 species are enumerated, belonging to 40 genera. Of these, 39 species are described as new, and a further 41 are new to the flora of British North Borneo. One new genus, *Neoclemensia*, is described. The genus *Chelonistele* is re-described, and a key to the species is given. A new section *Eurybrachion* of the genus *Dendrochilum* is described, with a key to the species; this section appears to be confined to Borneo. At the end of the paper is an index in which new species and new combinations are indicated in distinctive type.

The great wealth of the orchid flora of Mount Kinabalu is well shown by the fact that in six months Mr. Carr collected flowering specimens of approximately 700 species,

and this in spite of the fact that in the neighbourhood of Mt. Kinabalu there is hardly any lowland forest, which might be expected to have characteristic species not occurring on the mountain. It should be noted however that a number of species typical of lowland country in the Malay Peninsula were found at altitudes of well over 1,000 feet on Mt. Kinabalu. Thus Dendrobium pandaneti Ridl, in the Malay Peninsula confined to coastal rivers and rice fields, was twice found at above 1,000 feet altitude on Kinabalu.

Owing to Mr. Carr's very intimate knowledge of this family of plants and his exceptional ability as a collector, this collection is probably one of the most complete ever made in any comparable area in the Malayan region, and its record is therefore of exceptional interest.

APOSTASIACEÆ

Neuwiedia Lindleyi Rolfe in Journ. Linn. Soc. Bot. XXV (1889), 232, t. 48, f. 10-12.

C. 3387, SFN 27823, Dallas c. 4,000 feet, May, 1933. Distribution:—Sumatra, Malay Peninsula.

Apostasia odorata Bl. Bijdr. 423, t. 1, f. 5, etc.

Penibukan ridge c. 3,500 feet, March, 1933.

Clemens s.n. Kamborangah 8,000 feet, March 24th, 1932.

Clemens 26883, Dallas 3,000 feet, October 31st, 1931: 27696, Dallas 3,000 feet, December 30th, 1931.

Distribution:—Java.

ORCHIDACEÆ

Paphiopedilum javanicum Pfitz. in Engl. Bot. Jahrb. xix (1894), 40. etc.

C. 3163, SFN 26637, Menetendok, c. 3,000 feet, March, 1933.

Clemens 27618, Dallas-Tenompok ridge 4,000 feet, December 15th, 1931: 28716, jungle East of Tenompok camp 5,000 feet, March 8th, 1932.

Distribution:—Sumatra, Java.

Paphiopedilum Dayanum Pfitz. in Engl. Bot. Jahrb. XIX (1894), 40. etc.

C. 3036, SFN 26312, Penibukan ridge c. 3,500 feet, March, 1933.

Distribution:—Endemic.

Platanthera angustata Lndl. Gen. & Sp. Orch. 290. etc.

C. 3515, SFN 27521, Kamborangah, c. 7,200 feet, June, 1933.

Gardens Bulletin, S.S.

Distribution:- Java, Sumatra, Malay Peninsula.

Platanthera kinabaluensis Krzl. ex Rolfe in Journ. Linn. Soc. Bot. XLII (1914), 160: P. Gibbsiae Rolfe l.c.

C. 3523, SFN 27533, below Paka Paka, terrestrial in thin scrub c. 9,000-10,500 feet, June, 1933.

Clemens 29782, Tenompok 5,000 feet, May 27th, 1932.

Sepals and petals green to bright yellow-green. Lip yellow-green with paler margins, spur pale green or pale yellow-green.

I strongly suspect that *P. crassinervia* A. & S. and *P. borneensis* Ridl. represent other forms of this variable plant. The plant is locally common on the main spur from 9,000 to fully 10,500 feet altitude and I made a large collection. A plant very closely fitting the description of *P. crassinervia* A. & S. was found by me near camp at Paka Paka.

Distribution:—Endemic.

Platanthera Stapfii Krzl. ex Rolfe in Journ. Linn. Soc. Bot. XLII (1914), 160.

C. 3126, SFN 26560, Marei Parei spur, terrestrial in the open c. 5,000 feet, March, 1933. Flowers bright green. Distribution:—Endemic.

Platanthera saprophytica J. J. S. in Bull. Inst. allgem. Bot. Hamb. VII (1927), 12, t. 1, f. 2.

C. 3114, SFN 26511, terrestrial in tall forest above the Mahandui river on Penibukan Ridge c. 3,500 feet, March, 1933.

Distribution:—Endemic.

Peristylus candidus J. J. S. in Fl. Buit. VI. Orch. (1905) 36, Atlas f. 18.

C. 3320, SFN 27811, a common terrestrial plant in the neighbourhood of Bundu Tuhan c. 3,000 feet, April, 1933.

Distribution:—Sumatra, Malay Peninsula, Java, Celebes, Amboina and Boeroe.

Peristylus brevicalcar sp. nov. Caulis erectus, pervalidus, vaginis arcte tubulosis omnino tectus. Folia apicalia c. 5, late lanceolata, acuminata, acutissima. Inflorescentia brevis, densiflora, pedunculo brevi vaginis c. 3 obsesso. Bracteæ lanceolatæ, acuminatæ, acutissimæ. Sepalum dorsale oblongo-lanceolatum, obtusum, conicoapiculatum. Sepala lateralia elliptico-lanceolata, obtusa acute apiculata. Petala late ovata, abrupte acuminata, obtusa. Labellum 3-lobum, calcaratum, lamina oblonga,

lobis lateralibus anguste triangularibus obtusis quam lobo intermedio triangulari obtuso brevioribus, calcare breviter late ovoideo.

Stem erect, rather stout, covered with loosely tubular sheaths with funnel-shaped apex the upper ones with the apex long free lanceolate acute, c. 14 cm. long. apical c. 5, erecto-patent or spreading, broadly lanceolate, acuminate, very acute, up to c. 8 cm. long, c. 2.50 cm. wide, sheaths tubular c. 1.50 cm. long. Inflorescence short, densely many-flowered, peduncle provided with c. 3 large spreading sheaths c. 3.50 cm. long, rachis c. 4 cm. long. Bracts lanceolate, subulate-acuminate, very acute, c. 1.40 cm. long, c. .45 cm. wide. Flowers hardly expanded with white sepals and pale yellow petals. Dorsal sepal oblong-lanceo-late, obtuse, conic-apiculate, 1-nerved, margins minutely ciliolate, c. .58 cm. long, c. .27 cm. wide. Lateral sepals elliptic-lanceolate, acutely apiculate, keeled on the back, 1nerved, margins minutely ciliolate, c. .58 cm. long, c. .27 cm. wide. Petals broadly ovate, abruptly acuminate, obtuse, much thickened towards the apex, 3-nerved with the outer nerves much branched, anterior margin abruptly roundly dilate above the middle and adnate in the lower third to the lip, c. .58 cm. long, c. .32 cm. wide. Lip adnate to the column and to the anterior margin of the petals, 3-lobed, spurred, 3-nerved from the base with the outer nerves much branched, pale yellow with a white spur, spread out including the spur c. .60 cm. long, c. .30 cm. wide, blade oblong, side lobes crossed over the base of the midlobe narrowly triangular obtuse, midlobe longer and broader c. .17 cm. long c. .12 cm. wide, spur shortly and broadly ovoid very obtuse c. .12 cm. long and broader. Column stout, c. .18 cm. tall, auricles as long as the anther adnate beneath to the lip, apex crenate and rugose. Anther cells approximate, contiguous.

This plant is a close ally of *P. tobensis* J. J. S. and *P. goodyeroides* Lndl. but differs from both in the structure of petals and lip and in the minutely ciliolate sepals. In the only plant found the leaves were creamy white streaked with green and the bracts were white.*

C. 3353, near Bundu Tuhan at c. 3,000 feet altitude, April, 1933.

Described from dried material and flowers preserved in spirit.

^{*} From **P. Copelandii** Carr (Habenaria Copelandii Ames) from the Philippines it is distinct in the rather smaller flowers with different petals and lip with shorter spur and apical lobules. It is also allied to the Bornean **P. ovariophora** Carr (Habenaria ovariophora Schltr.) which has basal leaves and glabrous sepals.

Peristylus ciliatus sp. nov. Caulis erectus, elongatus, validus, foliosus, basi vaginatus. Folia remota c. 8, oblonga, breviter acuminata, acuta. Inflorescentia elongata, subdense multiflora. Bracteæ oblongo-lanceolatæ, longe subulato-acuminatæ, acutissimæ. Sepalum dorsale ovatum, obtusum. Sepala lateralia falcata, oblongo-lanceolata, acute apiculata. Petala e basi angusta late ovata, obtusa. Labellum 3-lobum, calcaratum, lobis lateralibus brevissimis falcatis anguste obtusis, lobo intermedio multo majore arcte triangulari obtuso, lobis carnosis, calcare magno ovoideo acuminato anguste obtuso.

Stem erect, elongate, stout, leafy with c. 4 tubular sheaths at the base, up to c. 56 cm. long. Leaves c. 8 in the upper 3/4, distant, oblong, shortly acuminate, acute, up to c. 19 cm. long, c. 5.50 cm. wide, sheaths tubular up to c. 7 cm. long. Inflorescence elongate, sub-densely very many-flowered, peduncle stout provided with 3-5 lanceolate acuminate acute sheaths, the lowest largest leaf-like, up to c. 29.50 cm. long, rachis often very elongate 22 to 52 cm. long. Bracts much exceeding the flowers, oblong-lanceolate, long subulate, very acute, lower ones largest up to 1.75 cm. long, c. .45 cm. wide. Flowers small, not widely expanded. Dorsal sepal ovate, obtuse, 1-nerved, margins minutely ciliolate, rather dark green, c. .45 cm. long, c. .27 cm. wide. Lateral sepals falcate, oblong-lanceolate, acutely apiculate, 1-nerved, keeled on the back, pale green darker along the middle, c. .50 cm. long, c. .25 cm. wide. Petals broadly ovate from a narrow base, obtuse, subfalcate, 2-nerved, much thickened towards the apex and along the anterior margin, minutely papillose, anterior margin adnate at the base to the lip, dark green with a paler base, c. .42 cm. long, c. .28 cm. wide. Lip adnate to the column and to the anterior margin of the petals, 3-lobed, spurred, spread out including the spur c. .74 cm. long, c. .30 cm. wide across the side lobes; blade concave green provided with a median whitish keel reaching nearly to the base of the midlobe and 2 very inconspicuous short whitish converging keels arising from the margin at the base of the free part, base elevate at the entrance to the spur; side lobes falcate, triangular, narrowly obtuse, fleshy, dark green, c. .06 cm. long; midlobe much larger, roundly triangular, obtuse, fleshy, dark green, c. .16 cm. long, c. .15 cm. wide at the base; spur stout, ovoid, acuminate, narrowly obtuse, provided with a short basal groove above, keeled beneath, green, c. .30 cm. long. Column c. .20 cm. tall, auricles exceeding the anther with the apex a little recurved and the base adnate to the lip. Anther cells approximate.

A large though small-flowered species of which I do not know a near ally.

C. 3368, SFN 27111, head of the Kulapis river c. 4,300

feet, terrestrial in tall damp forest, May, 1933.

Clemens 29816, Tenompok 5,000 feet, June 13th, 1932.

Described from dried material and flowers preserved in spirit.

Peristylus kinabaluensis sp. nov. Caulis erectus, gracilis, foliosus. Folia c. 7, anguste lanceolata, acuta. Inflorescentia elongata, laxe c. 12-flora. Bracteæ ovatæ, triangulari-acuminatæ, acutæ. Sepalum dorsale ellipticum, obtusum, conico-apiculatum. Sepala lateralia falcata, oblonga, obtusa, acute apiculata, extus apicem versus carinata. Petala oblique triangulari-ovata, obtusa. Labellum 3-lobum, calcaratum, lobis lateralibus anguste linearibus, lobo intermedio anguste triangulari obtuso, calcare gracili fusiformi anguste obtuso.

Stem erect, slender, leafy, c. 17 cm. tall, provided at the base with some short tubular sheaths. Leaves c. 7. narrowly lanceolate, acute, c. 9.50 cm. long, c. 1.40 cm. wide. sheaths tubular c. 3.50 cm. long. Inflorescence elongate, slender, very laxly c. 12-flowered, peduncle terete provided at intervals with 2 tubular sheaths c. 10 cm. long, rachis, c. 16 cm. long. *Bracts* spreading, ovate, triangular-acuminate, acute, 1-nerved, c. .47 cm. long, c. .28 cm. wide. small. Dorsal sepal elliptic, obtuse, conic-apiculate, 1-nerved, c. .20 cm. long. c. .16 cm. wide. Lateral sepals falcate, oblong, obtuse, acutely apiculate, keeled on the back towards the apex, 1-nerved, c. .26 cm. long, c. .13 cm. wide. Petals obliquely triangular-ovate, obtuse, falcate, anterior margin adnate to the lip almost up to the middle, 2-nerved with the anterior nerve branched, c. .27 cm. long, c. .18 cm. Lip with the margins of the claw adnate to the auricles of the column into a tube and long adnate to the petals, 3-lobed, spurred, 3-nerved, without the spur c. .40 cm. long, c. .75 cm. wide across the side lobes, side lobes narrowly linear very narrowly obtuse 1-nerved c. .37 cm. long, midlobe narrowly triangular obtuse c. .18 cm. long c. .10 cm. wide, spur slender fusiform narrowly obtuse little curved and parallel to the ovary pendulous c. .60 cm. long. Column c. .18 cm. tall, auricles clubbed exceeding the anther. Anther cells approximate.

This is apparently very near to *P. papuanus* J. J. S. from Dutch New Guinea but differs i.a. in the much shorter bracts and sepals, the narrower midlobe and shorter spur.*

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^{*} From P. staminodiata Carr (Habenaria staminodiata Schltr.) from the Celebes it differs in the rather longer much narrower leaves, longer inflorescence, rather different larger petals and in the longer spur of the lip.

C. 3389, SFN 27308, by a stream in very young secondary forest between Dallas and Tenompok c. 4,000 feet, May, 1933.

Described from dried material and flowers preserved in spirit.

- Peristylus Hallieri J. J. S. in Bull. Dep. Agr. Ind. neerl. XXII (1909), 1; Bull. Jard. Bot. Buit. II. Suppl. t. 2, f. II.
- C. 3489, SFN 27445, near Bundu Tuhan, c. 4,000 feet June, 1933. Sepals bright green. Petals and lip yellow-green, spur greenish with bright green apex.

Distribution: - Dutch Borneo, Sarawak.

Peristylus grandis Bl. Bijdr. 405, f. 30.

C. 3196, SFN 27149 Menetendok c. 3,000 feet, March, 1933. Sepals grey-green with paler margins and a darker median line. Petals green. Lip and column green. Leaves green with darker nerves.

Clemens 26770 Dallas 3,000 feet, September 28th, 1931; s.n. Dallas 3,000 feet, September 2nd, 1931; s.n. Dallas 3,000 feet, September 23rd, 1931.

Distribution:—Sumatra, Java, Malay Peninsula.

Peristylus goodyeroides Lndl. Gen. et Sp. Orch. 299.

C. 3575, SFN 27779 near Bundu Tuhan c. 3,000 feet, July, 1933.

Clemens 26314 Dallas 3,000 feet, September 3rd, 1931; 26482 Dallas 3,000 feet, September 23rd, 1931.

Distribution:—Sumatra, Java, Malay Peninsula, Philippines, Burma, Assam.

sp. nov. Habenaria (§ Salaccenses) setifolia Caulis elongatus, superne 5-6-folius. Folia obovata vel oblongo-obovata, breviter acuminata, apice brevissime fera, membranea. Inflorescentia laxe Bracteæ lanceolatæ, longe acuminatæ, acutato setifera, membranea. multiflora. Sepalum dorsale cucullatim convexum, acutissimæ. apice recurvo, a latere visum deltoideum apici acumina-Sepala lateralia subsigmoidea, anguste ovata, acuminata, obtusa, extus sub apice aristata. Petala super basin biloba, carnosula, lobo postico subulato, lobo intermedio dimidio inferiore anguste oblongo, medio bilobo lobulis anguste subulatis subæqualibus. Labellum 3-lobum, calcaratum, lobis lateralibus super basin bilobis laciniis anguste subulatis, lobo intermedio breviore et latiore subulato.

Stem erect, elongate, stout, sheathed below, 5-6-leaved above, more than 36 cm. tall (base missing). Leaves obovate or oblong-obovate, shortly acuminate, very shortly

acutate with an apical seta c. .20 cm. long, membraneous, up to c. 18.50 cm. long, c. 6.33 cm. wide. Inflorescence laxly many-flowered, peduncle provided with c. 3 lanceolate acuminate acute sheaths up to c. 3.33 cm. long, c. 12.50 cm. long, rachis more than 8.50 cm. long (upper part missing). Bracts spreading, lanceolate, long acuminate, very acute, c. 2.30 cm. long, c. .40 cm. wide. Dorsal sepal cucullately convex, seen from the side deltoid with apex acuminate and recurved, nerves 3 elevate outside, c. 1.05 cm. long. Lateral sepals subsigmoid, narrowly ovate, acuminate, obtuse, provided outside below the apex with an arista c. .27 cm. long, 3-nerved, c. 1.27 cm. long, c. .43 cm. wide. Petals free, bilobed c. .17 cm. above the base, posterior lobule subulate 3-nerved c. 1 cm. long, anterior lobule sigmoid narrowly oblong in the lower half bilobed from about the middle with the lobes subulate the anterior rather shorter than the posterior, in all c. 1.45 cm. long. Lip 3-lobed, spurred, c. 1.60 cm. long from base to apex of midlobe; side lobes bilobed c. .17 cm. above the base, lobes narrowly subulate, anterior lobule longer c. 1.70 cm. long; midlobe broader than the side lobes, subulate, c. 1.25 cm. long; spur cylindric, narrowed from the base to c. the middle, upper half a little dilate and incurved rounded on the back flattened in front, c. 1.80 cm. long. Column c. .35 cm. tall, anther canals c. .25 cm. long triangular with margins strongly inrolled, rostellum very short triangular blunt porrect c. .08 cm. long produced beneath to 2 divergent linear lobes c. .35 cm. long, stigmata oblong obtuse flattened beneath convex above c. .30 cm. long. Pollinia with caudicle c. .60 cm. long, caudicle filiform c. .40 cm. long, disc minute. Ovary and pedicel c. 2.50 cm. long.

The nearest affinity of this plant is the Javanese *H. bantamensis* J. J. S., from which it differs in the lobing of petals and lip, the blunt spur and the aristate lateral sepals.

Clemens 28323, Tenompok 5,000 feet February 10th, 1932. "Flowers green".

Described from dried material.

Habenaria damaiensis J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. VIII (1926), 35; l.c. II. Suppl. t. 3, f. IV.

C. 3641 near Kundasan, c. 3,500 feet, August, 1933. Bracts dark grey-green with paler margins and darker nerves. Dorsal sepal greyish white tinted pale grey-green, apical seta dark olive. Lateral sepals white with pale grey-green nerves and dark olive apical seta. Petals dark brownish olive with white base. Lip base white, lobes brownish olive with white base, spur brownish olive with white base. Column white, anther cells cream.

Clemens s.n. Tenompok 5,000 feet, February 24th, 1932. Distribution:—Dutch Borneo, Celebes.

Corybas crenulatus J. J. S. in Bull. Inst. allg. Bot. Hamb. VII (1927) 16, t. II, f. 6.

C. 3205, SFN 26841, Menetendok/Kinataki Divide, c. 3,500 feet, March, 1933. Leaf green with c. 5 white nerves and white reticulation. Dorsal sepal crimson with white apex and margins. Lateral sepals and petals white. Lip crimson with white margins and a large white median spot, spurs white.

Distribution:—Dutch West Borneo.

Corybas (§ Calcearia) kinabaluensis sp. nov. subglobosum, villosum. Caulis gracilis, quadrangularis. Folium sessile, caudatum, brevissime acuminatum, acutissimum. Bractea lineari-lanceolata, filiformiter Sepalum dorsale oblongum, breviter acuminata. cuneato-dilatatum, sub apice abrupte in laminam transverse ellipticam angulis acutis dilatatum, apiculalateralia anguste lineari-lanceolata, Sepala acuminata, acutissima. Petala sepalis lateralibus similia sed longiora. Labellum basi erectum intus in tuberculam parvam elevatum, medio fere valde recurvum, marginibus dimidio inferiore sese amplectantibus et tubam formantibus, dimidio superiore suborbiculare retusum parte media late elevata puberulum et papillosum canaliculatum, marginibus apici incurvis irregulariter denticulatis, carinis 2 brevibus conicis.

Tuber subglobose, villous, c. .60 cm. long, c. .45 cm. diam. Stem slender, quadrangular with a large basal tubular sheath, c. 2.50 cm. long, c. .15 cm. diam. Leaf sessile, cordate, very shortly acuminate, very acute, green often suffused red, nerves 3 and reticulation grooved above elevate beneath white but often red, margins shortly running down the stem, c. 1.90 cm. long, c. 1.50 cm. wide. Bract erect, linear-lanceolate, filiform-acuminate, c. .80 cm. long. Dorsal sepal oblong, slightly dilate upwards, abruptly dilate below the apex to a transversely elliptic apiculate blade with the lateral angles acute, 3-nerved at the base with the outer nerves branched, keeled and warty outside, apical margin minutely erose, crimson with white margins, dilate part whitish spotted crimson with the apiculus crimson, c. 1.85 cm. long, c. 1 cm. wide below the apex. Lateral sepals very narrowly linear-lanceolate, acuminate, very acute, 1-nerved, keeled outside, red tipped white, c. 1.85 cm. long, c. .16 cm. wide. Petals longer than the sepals, very narrowly linear-lanceolate, long acuminate, very acute, 1-nerved, keeled outside, red tipped white, c. 2.40 cm. long,

c. .16 cm. wide. Lip crimson with white margins, erect in the lower $\frac{1}{2}$ with a small conic tubercle inside at the point of attachment, strongly recurved about the middle, margins in the lower $\frac{1}{2}$ incurved and closely embracing each other and forming a tube, upper $\frac{1}{2}$ well expanded suborbicular c. .95 cm. long c. 1.10 cm. wide the anterior margin incurved retuse irregularly denticulate with the teeth crimson, broadly elevate along the middle with the elevate part puberulous and papillose with a median groove white dotted and suffused crimson, spurs 2 conic crimson c. .15 cm. long. Column c. .27 cm. tall, stigma strongly elevate orbicular with raised margins. Capsule ovoid with 3 strong ribs, c. .75 cm. long, c. .35 cm. diam.

C. 3067, SFN 26395, Penibukan Ridge at the head of the Mahandui valley, in moss, c. 4,000 feet, March, 1933.

Described from dried material and plants preserved in spirit.

Cryptostylis acutata J. J. S. in Bull. Jard. Bot. Buit. Sér. 3 III (1921), 243; l.c. V (1922), t. 24, III.

C. 3208, SFN 27132, Menetendok/Kinataki Divide c. 3,500 feet, March, 1933.

Clemens s.n. Kamborangah trail 7,000 feet, January 10th, 1932; s.n. Tenompok trail 4,000 feet, September 31st, 1931.

Distribution:—Java, Sumatra.

Cryptostylis arachnites Hassk. Cat. Bog. (1844) 8; Bl. Fl. Jav. n. ser. I (1858), 112, t. 45, f. 2.

C. 3508, SFN 27978 Kamborangah, c. 7,200 feet, June, 1933.

Clemens s.n. Lumu Lumu 6,000 feet, March 23rd, 1932.

Distribution:—Java, Sumatra, Malay Peninsula, Philippines.

Cryptostylis tridentata sp. nov. Folium oblongo-ovatum, breviter acuminatum, acutum, longe petiolatum. Inflorescentia erecta, elongata, laxe pauciflora. Bracteæ lanceolatæ, acutæ. Sepalum dorsale anguste oblongum, apici breviter 2-3-dentatum dente intermedio longiore. Sepala lateralia falcata, anguste oblongo-lanceolata, acuta cum denticulo minuto sub apice. Petala oblonga, apici tridentata dentibus exterioribus extrorsis dente intermedio longiore subulato, marginibus apicem versus minute ciliolatis. Labellum oblongum, super medium triangulariter acuminatum, minutissime apiculatum.

Leaf erect or erecto-patent, oblong-ovate, shortly acuminate, acute, c. 6.50 cm. long, c. 3,25 cm. wide, petiole c. 4.33 cm. long. Inflorescence erect, elongate, apex laxly

few-flowered, peduncle terete with some tubular sheaths at the base and 3-4 at intervals above c. 23 cm. long, rachis 3-4 cm. long. Bracts lanceolate, acuminate, acute, c. 1.10 cm. long, c. .30 cm. wide. Dorsal sepal narrowly oblong with the apex shortly 2-3-toothed the outer teeth minute, 3-nerved, pale green, margins strongly involute, c. 1.22 cm. long, c. .23 cm. wide. Lateral sepals falcate, narrowly oblong-lanceolate, acute with a minute tooth below the apex, 3-nerved, margins strongly involute, pale green, c. 1.30 cm. long, c. .20 cm. wide. *Petals* oblong with the apex truncate 3-toothed, outer teeth extrorse, median longer subulate, margins strongly involute minutely ciliolate towards the apex, pale green, c. .73 cm. long, c. .14 cm. wide. Lip erect at the base with the margins embracing the column, recurved below the middle, oblong, triangular-acuminate from above the middle, apex minutely apiculate, densely velutinous except at the base, 2 very inconspicuous keels below the bend with a broad low median keel above the bend not reaching the apex, bright red-brown spotted crimson, base greenish, spread out c. 1.50 cm. long, c. .72 cm. wide. Column very short, apex erose with a very short median tooth, pale greenish white, including the anther c. .27 cm. tall, stigma elevate transverse. Anther ovate, cream.

This plant is at once distinguished from the other members of the genus by the toothed sepals and petals. J. J. Smith, in Bull. Inst. allgem. Bot. Hamb. VII. 17, considers *Chlorosa Clemensii* A. & S. as a peloric state of a *Cryptostylis* and makes the new combination *Cryptostylis Clemensii* (A. & S.) J. J. S. and it appears possible that it is a monstrous state of the present plant.

C. 3089, SFN 26556, Penibukan Ridge c. 4,500 feet, March, 1933.

Described from dried material and flowers preserved in spirit.

Nervilia punctata Schltr. in Engl. Bot. Jahrb. XLV (1911), 402: Pogonia punctata Bl. Mus. I (1849) 32.

C. 3198, SFN 26796, Ulu Kagitang c. 3,500 feet, terrestrial in very young secondary forest, March, 1933.

Distribution:—Java, Sumatra, Malay Peninsula, New Guinea.

Galeola javanica B. & H. Gen. Pl. III (1883) 590.

C. 3199, SFN 26778, Ulu Kagitang c. 3,500 feet, terrestrial in very young secondary forest, March 1933; near Bundu Tuhan c. 4,000 feet, April, 1933: Clemens 27024, Dallas-Tenompok in wet ravine 4,500 feet, November 7th 1931.

Distribution:- Java, Sumatra, Malay Peninsula.

Vanilla sumatrana J. J. S. in Bull. Jard. Bot. Buit. ser. 3. II (1920), 22; l.c. II. Suppl. (1930), t. 6, II.

C. 3417, SFN 27334, Koung, c. 1,400 feet, May, 1933. Sepals and petals yellow with greenish base and dark green apex, the margins of the sepals green in the upper half. Lip white, the part adnate to the column speckled redpurple, the free part veined dark red-purple, apex pale green. Column white, the free part pale yellow. Anther white.

Distribution:—Sumatra.

Vanilla kinabaluensis sp. nov. Caulis elongatus, ascendens. Folia oblonga vel oblongo-lanceolata, breviter acuminata, obtusa vel subtruncata, ad. c. 32 cm. longa, c. 10.75 cm. lata, petiolo brevi sulcato. Inflorescentia elongata, dense multiflora, pedunculo brevissimo. Bracteæ late ovatæ, subacutæ. Flores magni. Sepalum dorsale oblanceolatum, obtusum. Sepala lateralia falcata, oblongo-oblanceolata vel obovata, subacuta. Petala anguste obovata, obtusa, extus valde carinata. Labellum 3-lobum, marginibus per 3/4 longitudinis gynostemio adnatis parte adnata cuneata, lobis lateralibus semi-orbicularibus marginibus valde undulatis, lobo intermedio breviter latissime ovato obtuso, disco intus carinato apicem versus in fasciam appendicarum cuneatarum denticularum instructo, fascia papillarum ramosarum medio lobi intermedii.

Stem elongate, climbing, stout, 6 m. or more tall. Leaves up to 10 cm. apart, oblong or oblong-lanceolate, shortly acuminate, obtuse or subtruncate with rather thickened margins, flaccid, up to c. 32 cm. long, c. 10.75 cm. wide, sheath grooved little twisted c. 1.50 cm. long. Inflorescence from the base of the leaf, elongate, very manyflowered, stout, peduncle c. .50 cm. long, rachis dense up to c. 27 cm. long or more. *Bracts* widely spreading, broadly ovate, subacute, fleshy, c. .60 cm. long, c. .40 cm. wide. Flowers large, well expanded, sepals and petals pale yellow. Dorsal sepal oblanceolate, obtuse, margins incurved, 9nerved, c. 6.15 cm. long, c. 2 cm. wide. Lateral sepals falcate, oblong-oblanceolate or obovate, subacute, margins incurved, 9-nerved with the outer nerves branched above the base, c. 5.30 cm. long, c. 2.15 cm. wide. Petals subsigmoid, narrowly obovate, obtuse, thickened inside along the median line, provided outside with a median low rounded rather flattened keel, 9-nerved with the outer nerves branched, c. 6.10 cm. long, c. 2.40 cm. wide. Lip 3-lobed towards the apex, white with the blade veined redpurple and a large pale yellow blotch towards the apex which is suffused red, spread out c. 4.80 cm. long, c. 3.85

cm, wide across the side lobes; blade cuneate, c. 3.70 cm. long, c. 3 cm. wide, the margins adnate to the sides of the column for the whole length, provided with a broad median keel shortly 3-ribbed below the apex and ending below the apex of the adnate part in a bundle of incurved cuneate white lamellæ c. .48 cm. tall c. .85 cm. wide with rounded denticulate apex and some smaller similar lamellæ in front with the lateral margin produced on each side at the apex to a long tooth c. .14 cm. tall c. .70 cm. wide; side lobes semi-orbicular, margins strongly undulate, c. 1.30 cm. long, c. 1.80 cm. wide; midlobe shortly very broadly ovate, obtuse, margins strongly undulate, provided in the middle with a large dense mass of branched dark crimson papillæ which is connected to the bundle of lamellæ on the blade by a short broad 5-ribbed keel, c. .50 cm. long, c. 1.40 cm. wide. Column with margins up to the stigma adnate to the blade of the lip, straight, only the apex a little incurved, c. 4.25 cm. tall, rostellum large quadrate with rounded apex completely covering the stigma, anterior margin of stigma Anther oblong, shortly retuse above, a little recurved above the middle, c. .35 cm. long, c. .33 cm. wide.

This plant is very closely allied to *V. abundiflora* J. J. S., also a Bornean species, but the flowers are larger and the lip, which is more distinctly 3-lobed, differs in the presence of a median keel on the blade, the lack of irregularly seriate warts and in other details. The plant is best distinguished, however, by the lack of appendages on the column.

Rolfe, in Journ. Linn. Soc. XXXII. (1896), 460 refers, under his description of *V. borneensis*, to a flowerless plant collected on the Tampassuk river, *i.e.* the same locality as the present plant, by F. W. Burbidge, a sketch of which is in the British Museum. It appears possible that the plant referred to may belong in fact to the species here described.

C. 3157, Kadamaian (Tampassuk) river c. 2,700 feet, climbing up trees in damp forest at the entrance to Menetendok Gorge, March, 1933.

Clemens 26300, Dallas, 3,000 feet, climbing up trees for 30 feet, August, 1931; 26725, Dallas 3,000 feet, September 15th, 1931.

Described from dried material and flowers preserved in spirit.

Lecanorchis multiflora J. J. S. in Bull. Jard. Bot. Buit. Ser. 2. XXVI (1918), 8; l.c. Ser. 3. V. t. 25, f. II.

C. 3206, SFN 26801 Kinataki stream near Menetendok Gorge c. 3,500 feet, March, 1933.

Distribution:—Java.

Didymoplexis (§ Leucolæna) kinabaluensis sp. nov. Rhizoma cylindricum. Inflorescentia erecta, elongata, gracilis, apici dense multiflora. Bracteæ brevissimæ, reflexæ. Sepalum dorsale cum petala in laminam 3-lobam agglutinata, lamina basi sepalis lateralibus breviter adnata, parte libera ovata obtusa. Sepala lateralia in laminam profunde bipartitam adnata, parte libera ovata obtusa. Labellum 3-lobum, breviter unguiculatum, ungui in callum bilobum elevato, super callum carinatum, lobis lateralibus magnis subfalcatis anguste oblongo-obovatis, obtusis lobo intermedio minore triangulari acuminato anguste obtuso. Gynostemium apicem versus dilatatum, stelidiis abrupte decurvis subulatis.

Rhizome cylindric, tapering towards the apex, manynoded with c. 10 tubercular swellings at each node, emitting 2-3 slender roots near the apex, 8 cm. or more long, internodes c. .30 cm. long. Inflorescence erect, elongate, slender, dull brown-purple, peduncle up to c. 39 cm. long, rachis densely many-flowered up to c. 13 cm. long. Bracts reflexed. ovate, acuminate, acute, c. .13 cm. long. Dorsal sepal and petals adnate into a cuneate 3-lobed blade which is adnate at the base for c. .13 cm. to the lateral sepals, sparsely warty outside, dull brown-purple, darker in the middle, margins white, c. .90 cm. long, c. 1.05 cm. wide, Free part of dorsal sepal ovate, obtuse, c. .53 cm. long, c. .39 cm. wide. Lateral sepals adnate into an ovate deeply bifid blade which is adnate at the base for c. .13 cm. to the dorsal sepal and petals, sparsely warty outside, similar in colour to the dorsal sepal and petals, c. .63 cm. long, c. .83 cm. wide, free part ovate obtuse c. .40 cm. long c. .45 cm. wide. Lip 3-lobed, shortly clawed at the base, the claw provided with a conic callus which is bilobed in front with a rather wide sinus, a median keel from the callus to the apex of the lip, spread out c. .55 cm. long, c. .75 cm. wide across the side lobes, white, the midlobe suffused pale dull purple darker in the middle, base of claw brown-purple, callus blue-green, claw oblong c. .20 cm. long, side lobes large narrowly oblongobovate obtuse with the anterior margin faintly erose c. .40 cm. long c. .20 cm. wide, midlobe much smaller triangular acuminate narrowly obtuse c. .20 cm. long. Column c. .47 cm. tall, white, stelidia abruptly decurved subulate, stigma transversely obreniform. Anther broadly transversely oval.

This species is nearest to *D. Trichechus* J. J. S. from Sumatra. In the structure of the lip it closely resembles *D. philippinensis* Ames from the Philippines but that plant has no stelidia and belongs to the section *Eudidymoplexis*.

C. 3155, SFN 26606, Menetendok Gorge c. 3,000 feet, terrestrial in wet forest, March, 1933.

Described from dried material and flowers preserved in spirit.

Gastrodia grandilabris sp. nov. Rhizoma cylindricum. Inflorescentia elongata, apici laxe ad c. 5-flora. Bracteæ ovatæ, subacutæ. Flores campanulati, sepalis petalisque in tubum latum adnatis, sepalis parte libera ovatis obtusis extus verrucosis. Petala, parte libera, minora, ovata, anguste obtusis. Labellum unguiculatum, lamina apici 3-loba, ungui transverse oblongo apici in callis 2 transverse oblongis instructo, lamina ex ungui constrictione transversa separata abrupte dilatata carinis 3 instructa, lobis lateralibus rotundatis medio margines prope carinis 2 elevatis basin lobi intermedii attingentibus, lobo intermedio ovato obtuso medio callo oblongo sulcato donato. Gynostemio valido, brachiis triangularibus acutis, marginibus sub medio late triangulariter dilatatis, stigmate super basin suborbiculari margine antico paulo elevato.

Rhizome cylindric, tapering towards the apex, c. 8 cm. more long. Inflorescence elongate, slender, erect, peduncle terete furnished with c. 5 short tubular sheaths. up to 27 cm. long, rachis c. 5-flowered c. 2.30 cm. long. Bracts ovate, subacute, c. .50 cm. long, c. .35 cm. wide. Flowers campanulate with the sepals and petals adnate into a tube dull brown-purple darker in the middle with white margins. Dorsal sepal in all c. 1.50 cm. long, the free part ovate obtuse or very shortly retuse, margins incurved at the apex, 3-nerved, tumid wrinkled and coarsely warty outside, c. .60 cm. long, c. .95 cm. wide. Lateral sepals c. 1.40 cm. long, free part ovate, obtuse, 4-nerved, wrinkled coarsely warty and keeled outside, margins incurved at the apex, c. .60 cm. long, c. 1.25 cm. wide. Petals c. 1.30 cm. long, free part ovate narrowly obtuse 1-nerved c. .37 cm. long c. .40 cm. wide. Lip large for the genus, clawed, 3lobed, keels 3 on the blade between the side lobes the outer a little diverging and reaching to above the middle of the lip the median produced to the midlobe and there dilate to an oblong grooved callus, transversely grooved in the middle white, the midlobe suffused pale dull brown-purple and the base of the claw brown-purple, spread out c. .85 cm. long, c. .57 cm. wide, claw transversely oblong with 2 transversely oblong blue-green calli at the apex, blade separated from the claw by a transverse constriction abruptly dilate from the base and forming with the side lobes a quadrate blade minutely transversely wrinkled, side lobes short broadly rounded, provided in the middle of the margins with 2 converging keels which reach to the base of the midlobe. midlobe ovate obtuse margins minutely erose. Column stout, white, c. .90 cm. tall, c. .50 cm. wide below the middle.

arms triangular acute, sides broadly triangularly dilate below the middle, clinandrium excavate suborbicular, stigma borne near the base suborbicular with the anterior margin a little elevate. *Anther* subquadrate, shortly keeled, beak very short rounded, white, c. .15 cm. long, c. .13 cm. wide. *Capsule* ovoid, c. 2.50 cm. long.

This plant appears to be very close to G. crispa J. J. S. from Java but it differs in the smaller sepals, the larger lip with very different keels and the longer column with the sides much dilate below the middle. As the capsule ripens the pedicel elongates to c. 20 cm.

C. 3264, SFN 26970, Tenompok/Ranau path saprophytic in humus in tall forest c. 4,800 feet, April, 1933.

Described from dried material and flowers preserved in spirit.

NEOCLEMENSIA Gen. nov.

Planta saprophytica, efoliosa. Rhizoma cylindricum, villosum. Inflorescentia pauciflora. Sepala in tubum adnata, apici tantum libera. Petala basi sepalis adnata, ceterum libera, sepalis multo breviora. Labellum gynostemio adnatum, integrum, basi bicallosum. Gynostemium eo Gastrodiae simile, stigmate super basin inserto. Anthera subquadrata.

A leafless saprophyte with the habit of *Gastrodia*. Rhizome cylindric, villous. Inflorescence few-flowered. Sepals adnate into a tube, apex free. Petals adnate to the sepals at the base only, remainder free much shorter than the sepals. Lip adnate to the base of the column, entire, base bicallose. Column similar to that of *Gastrodia*, the stigma borne above the base. Anther subquadrate, 2-celled.

Neoclemensia spathulata sp. nov. Rhizoma cylindricum, villosum, validum. Inflorescentia erecta, apici laxe pauciflora. Bracteæ lanceolatæ, subacutæ. Sepala in tubum adnata, apicem versus libera, sepalo dorsali (parte libera) suborbiculari vel oblongo-ovato apici minute bidentato, sepalis lateralibus (parte libera) ovatis obtusis extus carinatis. Petala basi sepalis breviter adnata, ceterum libera, linearia, apicem prope in laminam ovatam vel suborbicularem longius fimbriatam abrupte dilatata, carnosa, sepalis multo breviora. Labellum integrum, unguiculatum, ungui subquadrato apici in callis 2 subglobosis papillosis et vesiculosis instructo, lamina anguste elliptica obtusa omnino transverse rugulosa dimidio superiore carina brevi biloba donata marginibus minute erosulis papillosisque. Gynostemium validum, brachiis erectis triangularibus acutis, lateribus apicem versus dilatatis

compressis, ventri carinis 2 e rostello usque ad stigma productis, stigmate super basin more *Gastrodiae* orto oblongo.

Rhizome cylindric, villose, stout, part present c. 2.50 cm. long, c. .80 cm. diam. Inflorescence erect, véry laxly c. 3-flowered, apparently purplish in colour, peduncle terete with c. 6 tubular sheaths at intervals c. 10 cm. long, rachis c. 4.25 cm. long. Bracts appressed to the pedicel, lanceolate, subacute, c. .75 cm. long, c. .30 cm. wide. Flowers campanulate, c. 2.50 cm. long. Sepals adnate into a tube, free and recurved c. a third below the apex, white, free part warty and wrinkled outside. Dorsal sepal in all c. 3.40 cm. long, free part suborbicular or oblong-ovate minutely bidentate c. 1.30 cm. long c. 1.50 cm. wide. Lateral sepals in all c. 3.50 cm. long, free part ovate obtuse keeled outside margins incurved c. 1.40 cm. long c. 1.60 cm. wide. Petals adnate at the base to the lateral sepals for c. .15 cm., remainder free much shorter than the sepals, linear, abruptly dilate near the apex into an ovate or suborbicular rather longfimbriate blade, fleshy, 3-nerved, bright orange, c. 1.30 cm. long, spathulate part including the fimbriæ c. .25 cm. long c. .35 cm. wide. Lip adnate to the base of the column, entire, clawed, apparently dull greenish suffused olivebrown towards the apex, 3-nerved, spread out c. 1.35 cm. long, c. .37 cm. wide, claw oblong or subquadrate provided at the apex with 2 subglobose papillose and vesiculose calli, blade narrowly elliptic obtuse entirely transversely rugulose with a short median bilobed keel in the upper 1/2 margins erect minutely erose and papillose with a short fold below the apex. Column stout, c. .90 cm. tall, arms erect triangular acute, margins dilate and flattened towards the apex, 2 parallel keels run from the rostellum to the apex of the stigma, clinandrium deeply excavate suborbicular, stigma borne above the base in the manner of Gastrodia oblong keeled inside, apparently whitish darker between the keels and with orange apex and green base. Anther subquadrate, retuse, a little flattened above, 2-celled, c. .15 cm. long and as broad. Ovary clavate, dull purple, c. .45 cm. long.

This new genus is very close to *Gastrodia* from which it differs principally in the fact that the petals are almost entirely free and much shorter than the sepals.

Penibukan Ridge c. 3,500 feet, Clemens without number, September, 1933.

Described from dried material.

Erythrodes triloba sp. nov. Caulis basi repens, superne erectus. Folia 4-5, obliqua, oblonga, breviter acuminata, acuta. Inflorescentia erecta, superne dense

multiflora. Bracteæ ovatæ, longe acuminatæ, acutæ, extus dense pilosæ, marginibus ciliatis. Sepalum dorsale oblongum, obtusum, extus clavato-pilosum. Sepala lateralia subfalcata, e basi leviter angustata oblonga, obtusa, extus clavato-pilosa. Petala oblanceolata, obtusa, extus sulcata et medio nonnullis pilis donata. Labellum 3-lobum, calcaratum, lobis lateralibus brevibus rotundatis, lobo intermedio latiore transverse elliptico breviter apiculato sulcato super basin utrinque paulo elevato margines versus papilloso, calcare recto ventre dorsoque compresso breviter bilobo intus utrinque carinato exappendiculato.

Stem creeping and prostrate at the base and emitting a stout terete villose root from each node, erect and leafy above. Leaves 4-5, oblique, oblong, shortly acuminate, acute, grey-green, c. 7.50 cm. long, c. 2.80 cm. wide, petiole 1-2 cm. long, sheath tubular dilate at the apex, up to c. 1.50 cm. long. Inflorescence erect, densely many-flowered, peduncle terete hairy provided with c. 7 lanceolate acute cm. long. sheaths c. 20 cm. long, rachis hairy up to c. 6.50 cm. long. Bracts ovate, long acuminate, acute, 3-nerved, densely hairy outside, margins ciliolate, c. 1.15 cm. long, c. .40 cm. wide. Flowers well expanded, the sepals light brown, clavate-hairy Dorsal sepal oblong, obtuse, 3-nerved, margins ciliate, c. .58 cm. long, c. .18 cm. wide. Lateral sepals reflexed, base a little narrowed, oblong, obtuse, 3-nerved, c. .58 cm. long, c. .26 cm. wide. Petals agglutinate to the dorsal sepal forming a hood, oblanceolate, obtuse, grooved outside with a few hairs in the middle, c. .55 cm. long, c. .15 cm. wide, white, suffused pale brown down the middle and towards the base. Lip 3-lobed, spurred, white, suffused dark brown at the base of the blade, spread out with the spur c. .93 cm. long, c. .28 cm. wide; side lobes very short, erect, roundly triangular, very obtuse; midlobe broader than the side lobes, transversely elliptic, shortly apiculate, grooved in the middle with a low elevation on each side near the base, papillose near the margins, c. .15 cm. long, c. .28 cm. wide; spur straight, slightly dilate below the apex, flattened in front and on the back, provided inside with 2 lateral keels which run the whole length and terminate below the tip, c. .45 cm. long. Column white, c. .40 cm. tall, rostellum narrowly triangular with bifid apex, stigma semiorbicular with the posterior margin ending in 2 teeth. Anther oblong, triangular-acuminate from c. the middle, provided above with a broad tapering keel, base shortly bilobed, pale brown, c. .37 cm. long.

This plant appears to be next to *E. Wenzelii* Ames from the Philippines from which it differs in the 3-lobed lip and the keels of the spur.

C. 3564, SFN 27859, Tenompok c. 4,700 feet, terrestrial by the bridle path to Ranau, June, 1933.

Clemens 27689, Tenompok 5,000 feet, February 24th, 1932; 28420, Tenompok 5,000 feet, February 13th, 1932.

Described from dried plants and flowers preserved in spirit.

Erythrodes humilis J. J. S. in Bull. Dep. Agr. Ind. Neerl. xiii (1907), 11.

C. 3771, Kiau c. 3,000 feet, March, 1933.

Distribution:- Java, Sumatra, Malay Peninsula.

Vrydagzynea albida Bl. Fl. Jav. n. ser. I, Orch. (1858) 61, t. 20, f. 3.

C. 3765, SFN 28057, Ulu Kulapis c. 4,500 feet, June, 1933.

Clemens s.n. Tenompok 5,000 feet, March 4th, 1932. Distribution:—Java, Sumatra, Malay Peninsula, Philippines.

Vrydagzynea bractescens Ridl. in Kew Bull. 1926, 87.

C. 3766, Lobang c. 4,000 feet, April, 1933. Sepals greenish tipped white. Petals and lip white.

Distribution:—Sumatra.

Vrydagzynea elata Schltr. in Fedde Rep. IX (1911), 430.

C. 3384, SFN 27979, near Bundu Tuhan at c. 4,000 feet altitude, May, 1933. Leaves dark olive above with 3 paler nerves, beneath pale olive suffused pale purple with 3 bright olive nerves. Stem dull purple, sheaths dull red-purple. Inflorescence green. Bracts pink with olive base. Sepals green, the upper half white turning cream with a dull brown median spot. Petals, lip and spur white.

Distribution:—Sarawak.

Vrydagzynea argentistriata sp. nov. Caulis basi breviter repens, radicans, ceterum erectus, apicem versus foliatus. Folia c. 6, obliqua, lanceolata, acuta. Inflorescentia brevissima, dense multiflora. Bracteæ oblongovatæ, acuminatæ, anguste obtusæ, extus basin versus pubescentes, marginibus ciliatis. Sepalum dorsale dimidio inferiore oblongum, medio fere angustatum, dimidio superiore anguste oblongum obtusissimum. Sepala lateralia multo majora, oblique oblonga, acuminata, anguste obtusa. Petala brevia, oblique ovata, acuminata, obtusissima, margine antico basi in lobum rotundatum conspicue dilatato. Labellum integrum, calcaratum, lamina oblonga apicem obtusissimum

versus dilatata medio incrassata et papillosa, calcare ovoideo obtuso intus appendicibus 2 ovoideis stipitatis stipitibus dimidio apicali liberis donato.

Stem shortly creeping at the base, remainder erect leafy towards the apex dull brownish green or brownish purple c. 16 cm. tall. Leaves c. 6, oblique, lanceolate, acute, margins undulate, bright green slightly glistening above often with darker reticulation and a silver median line and silver margins, beneath dark grey-green with 3 darker nerves, c. 4.30 cm. long, 1.40-2.20 cm. wide, sheaths loosely tubular pale grey-green with fuscous nerves together with the short petiole c. 1.30 cm. long. Inflorescence very short, densely many-flowered, peduncle c. .50 cm. long, rachis c. 1.50 cm. long. Bracts oblong-ovate, acuminate, narrowly obtuse, 1-nerved, outside pubescent towards the base keeled towards the apex, margins ciliate, c. .78 cm. long, c. .25 cm. Sepals olive green often suffused dull red, the apex white. Dorsal sepal oblong, narrowed about the middle then narrowly oblong very obtuse, thickened and fleshy in the upper third except on the margins, 1-nerved, c. .40 cm. long, c. .13 cm. wide. Lateral sepals much larger, obliquely oblong, acuminate, narrowly obtuse, 1-nerved, thickened and fleshy along the middle in the upper $\frac{1}{2}$, c. .55 cm. long, c. .20 cm. wide. Petals short, obliquely ovate, acuminate, very obtuse, 1-nerved, thickened and fleshy in the upper $\frac{1}{2}$, not clawed at the base, white, c. .30 cm. long, c. .17 cm. wide. Lip entire, spurred, white, including the spur c. .68 cm. long, grooved beneath for the whole length; blade oblong, a little dilate below the very obtuse apex, margins incurved from above the base and contiguous towards the apex, broadly elevate and papillose along the median line, spread out c. .34 cm. long, c. .20 cm. wide; spur straight, ovoid, obtuse, flattened on the back, flattened and grooved in front, a little laterally dilate about the middle, provided inside with 2 ovoid stipitate dull ochre-yellow glands with the pedicel free only in the upper ½, white, c. .34 cm. long, c. .18 cm. diam. Column dilate upwards from a narrow base with 2 divaricate keels from the base to the apex of the stigmata separated by a triangular depression, stigmata 2 triangular obtuse, in all c. .25 cm. tall. Anther ovate. acuminate, acute, c. .23 cm. long.

This species is of the affinity of V. albida Bl. and may readily be distinguished by the marked difference in the dimensions of the sepals and by the small characteristic petals. The leaves with their silver median streak and narrow silver margins are also a distinguishing feature.

C. 3713, SFN 28051, near Bundu Tuhan c. 3,000 feet. Plants were brought alive to Singapore where they flowered in October, 1933.

Described from dried plants and flowers preserved in spirit.

Vrydagzynea bicostata sp. nov. Caulis basi breviter repens, ceterum erectus c. 6-folius. Folia oblique elliptica, breviter acuminata, acuta, nervis superne reticulatis omnino elevatis. Inflorescentia brevia, multiflora. Bracteæ floribus fere æquimagni, lanceolatæ, acuminatæ, acutæ. Sepalum dorsale oblongum, acuminatum, obtusum, apicem versus incrassatum. lateralia majora, oblongo-ovata, breviter Sepala acuminata, obtusa, apice incrassate. Petala longius unguiculata, lamina oblique ovata breviter acuminata obtusa, apicem versus incrassata. Labellum integrum, calcaratum, lamina elliptica obtusa marginibus apicem versus incurvis contiguisque apici papillosis medio bicarinata carinis apicem versus clavato-dilatatis, calcare cylindrico obtuso apicem versus recurvo et ovario appresso intus glandulis 2 ovoideis pedicellatis pedicellis longe liberis donato.

Stem shortly creeping at the base and emitting a stout villose root from each node, remainder erect, stout, leafy towards the apex, c. 27 cm. long, internodes up to c. 4.50 cm. long. Leaves c. 6, obliquely elliptic, shortly acuminate, acute, shiny dark green above with elevate nerves and reticulation, c. 7.75 cm. long, c. 4.50 cm. wide, petiole grooved c. 1.50 cm. long, sheaths loosely tubular up to c. 1.75 cm. long. Inflorescence short, densely many-flowered, peduncle up to c. 1.50 cm. long provided with some large bract-like sheaths, rachis c. 3 cm. long. Bracts very large, as long as the flower, broadly lanceolate, acuminate, acute, 1-nerved, margins ciliate, c. 1.65 cm. long, c. .38 cm. wide. Sepals bright green more or less suffused red. Dorsal sepal oblong, acuminate, obtuse, thickened and fleshy towards the apex, 1-nerved, apiculate, c. .50 cm. long, c. .19 cm. wide. Lateral sepals larger and much broader, obliquely oblongovate, shortly acuminate, obtusely apiculate, apex thickened and fleshy, 1-nerved, anterior margin produced and roundly dilate at the base, c. .56 cm. long, c. .33 cm. wide. Petals clawed at the base, white, 1-nerved, c. .47 cm. long, c. .18 cm. wide, claw oblong c. .12 cm. long, blade falcate obliquely ovate shortly acuminate obtuse convex and grooved outside about the middle apex thickened and fleshy. Lip entire, spurred, white, in all c. .98 cm. long; blade elliptic, obtuse, provided along the middle with 2 clubbed keels which do not reach the apex, margins incurved contiguous and papillose at the apex, c. .42 cm. long, c. .27 cm. wide; spur cylindric, obtuse, a little recurved and appressed to the ovary below the apex, grooved on the back, provided inside

with 2 pedicelled ovoid glands with the pedicels free for more than ½ their length, c. .48 cm. long. Column stout, c. .33 cm. tall, rostellum subulate, stigmata 2 quadrate the apex truncate and a little recurved. Anther cordate, shortly keeled in front, beak short triangular acute, c. .20 cm. long, c. .18 cm. wide.

This rather distinct species may readily be recognised by the elevate nerves and reticulation of the leaves, the rather long-clawed petals, the 2-keeled lip blade and the short cordate anther.

C. 3344, SFN 27134, Upper Kinunut valley c. 4,000 feet, April, 1933.

Described from dried plants and flowers preserved in spirit.

Vrydagzynea grandis A. & S. Orch. VI (1920), 16.

C. 3195, SFN 26776, Lobang c. 4,200 feet, March, 1933. Leaves green. Ovary white tipped green. Sepals green tipped white. Petals whitish. Lip white.

Clemens 28242, Tenompok 5,000 feet, February 5th, 1932; 28344, Tenompok 5,000 feet, February 11th, 1932.

Distribution:—Endemic.

Anœctochilus setaceus Bl. Bijdr. 412, f. 15; Fl. Jav. Orch. 38, t. 12, f. 1, t. 17 A.

C. 3084, SFN 26533, Penibukan Ridge c. $4{,}500$ feet, March, 1933.

Clemens s.n. below Lumu Lumu? 5,000 feet, January 7th, 1932.

Distribution:—Java.

Anæctochilus integrilabris sp. nov. Caulis basi repens radicans, deinde erectus c. 4-5-folius. Folia oblique ovata, acuta, marginibus undulatis. Inflorescentia erecta, apici laxe ad c. 6-flora. Bracteæ triangulariovatæ, acutæ, extus pilosæ. Flores vix expansi. Sepalum dorsale late lanceolatum, breviter acuminatum, acutum, extus clavatopilosum. Sepala lateralia oblonga, breviter acuminata, acuta, super medium paulo dilatata, extus clavato-pilosa. Petala oblonga triangulariter acuminata, acuta, super medium leviter dilatata, extus sulcata. Labellum integrum, calcaratum, lamina late lanceolata abrupte acuminata acuta marginibus apici incurvis contiguisque extus margines prope sub medio usque ad apicem fere utrinque fimbriis c. 10 donata, calcare ovoideo vel conico apici inæqualiter et brevissime bilobulo intus sub apice glandula verrucosa.

Stem creeping at the base and emitting a villose root from each node, then erect rather slender with c. 4-5 leaves, c. 12 cm. long or more. Leaves obliquely ovate, acute, undulate, margins verv dark shiny green with nerves and reticulation pale flesh colour or pink, pinkish purple beneath, 1.50-4.75 cm. long, 1-3.50 cm. wide, petiole grooved together with the tubular pink sheaths c. 1-1.50 cm. long. *Inflorescence* erect, laxly c. 6-flowered or less, very pale greenish, peduncle up to 16 cm. long clothed at intervals with 2-3 pink sheaths which are shortly tubular at the base with the free part ovate acute, rachis up to c. 2.50 cm. long. Bracts triangular-ovate, acute, hairy outside, bright rose, c. 1.50 cm. long, c. .85 cm. wide. Flowers not widely expanded, the sepals clavate-hairy bright rose-red with olive green base outside, whitish inside. Dorsal sepal broadly lanceolate, shortly acuminate, acute, 1-nerved, c. 1.07 cm. long, c. .45 cm. wide. Lateral sepals oblong, shortly acuminate, acute, a little dilate above the middle, 1-nerved, anterior margin produced and roundly dilate at the base embracing the lip, c. 1.07 cm, long, c. .42 cm. wide. Petals oblong, triangular-acuminate from above the middle, acute, a little dilate above the middle, grooved outside, 1-nerved, pure white, c. 1.05 cm. long, c. .30 cm. Lip entire, spurred, pure white, spread out including the spur c. 1.45 cm. long, c. .45 cm. wide across the blade; blade lanceolate, abruptly narrowed about the middle and acuminate, acute, margins incurved and contiguous at the apex remainder erect provided beneath near the margins on each side with c. 10 fimbrize of which the inner 4 are longer and c. .50 cm. long the 3 outer ones on each side tapering, c. 1.02 cm. long, c. .45 cm. wide; spur ovoid or conic, flattened and grooved beneath, apex oblique or minutely and unequally bilobed, provided inside near the tip with a coarsely warty gland, c. .43 cm. long, c. .23 cm. diam. Column white, c. .70 cm. long, the underside provided with 2 triangular shortly acuminate fleshy keeled lamellæ, clinandrium deeply excavate suborbicular or subquadrate convex inside, stigmata 2, oblong elevate wrinkled separated by a suborbicular excavation. Ovary densely long hairy, c. 1.50 cm. long.

Undoubtedly this is a close ally of *A. insignis* Schltr. from the Celebes but it differs distinctly in the smaller stature, smaller sepals and petals and rather different lip.

C. 3162, SFN 26634, at the entrance to Menetendok Gorge c. 2,700 feet, March, 1933, terrestrial in very young secondary forest.

Described from dried material and flowers preserved in spirit.

Myrmechis kinabaluensis sp. nov. Caulis basi repens, superne erectus. Folia ad c. 9, ovata, acuta, marginibus minute undulatis. Inflorescentia erecta, apici 1-3-flora. Bracteæ triangulari-ovatæ. Sepalum dorsale lanceolatum, obtusum. Sepala lateralia subfalcata, oblongo-lanceolata, obtusa. Petala oblongo-lanceolata, acuminata, obtusa, extus sulcata. Labellum integrum, basi saccatum, lamina oblonga obtusa marginibus ¼ parte apicali excepta valde incurvis contiguis tubum formantibus, sacco subgloboso intus utrinque glandula subglobosa sessili donato.

Stem creeping and rooting at the base, erect and leafy above, up to c. 17 cm. long, internodes up to c. 2.75 cm. long. Leaves up to c. 9, ovate, acute, margins minutely undulate, green, 1.10-1.75 cm. long, .65-1.10 cm. wide, petiole grooved c. .24 cm. long, sheath infundibuliform as long. Inflorescence very short, erect, 1-3-flowered, peduncle c. .70 cm. long provided with a large ovate acute sheath, rachis in flowering c. .50 cm. in fruiting c. 2.80 cm. long. Bracts triangular-ovate, acute, keeled outside, green, c. .80 cm. long, c. .53 cm. wide. *Flowers* not well expanded, pure white. Dorsal sepal lanceolate, obtuse, 1-nerved, warty outside, c. .70 cm. long, c. .35 cm. wide. Lateral sepals subfalcate, oblong-lanceolate, obtuse, 1-nerved, anterior margin produced and rounded at the base, keeled and warty outside, c. .70 cm. long, c. .35 cm. wide. Petals free, oblonglanceolate, obtuse, grooved outside, c. .65 cm. long, c. .30 cm. Lip entire, saccate at the base, spread out c. .70 cm. long, c. .25 cm. wide across the sac, blade oblong obtuse with the margins strongly incurved and contiguous in the lower 3/4 forming a tube, the apical margin suberect c. .37 cm. long, sac subglobose provided within on each side with a subglobose sessile entire glabrous gland c. .33 cm. long c. Column dilate upwards, c. .20 cm. tall. .28 cm. wide. provided in front with a short keel ending above in 2 minute tubercles, rostellum very short triangular bilobed with a broad rounded sinus, stigmata 2 widely separated suborbicular. Anther cordate, acuminate, very obtuse. Pollinia 2 pyriform, grooved, attached near the middle of an orbicular disc.

C. 3539, SFN 27595, above Kamborangah c. 9,000 feet, terrestrial in very wet, mossy, though rather stunted forest, June, 1933.

Clemens 29217, Masilau 7,000 feet, April 9th, 1932.

Described from dried material and flowers preserved in spirit.

Zeuxine strateumatica Schltr. Orch. D. N. Guinea (1911),

C. 3722, SFN 28053, near Dallas c. 3,000 feet, brought alive to Singapore where it flowered in October, 1933.

Clemens 27555, Dallas 3,000 feet, December, 1931.

Distribution:—Java, Sumatra, Malay Peninsula, Amboina, Philippines, China, Japan, Afghanistan, Assam, India and Ceylon.

Zeuxine gracilis Bl. Fl. Jav. n. ser. I (1858), 56, t. 18, f. 2, t. 23 D.

C. 3177, SFN 26756, terrestrial by the side of the Kadamaian river above Menetendok Gorge c. 2,800 feet, March, 1933.

Distribution:- Java, Sumatra, Malay Peninsula.

Zeuxine papillosa sp. nov. Caulis basi breviter repens, ceterum erectus, gracilis. Folia c. 5, ovata vel ovato-lanceolata, acuta. Inflorescentia erecta, gracilis, pauciflora. Bracteæ ovatæ, acuminatæ, acutæ, extus pilosæ et papillosæ. Sepala extus papillosa pilosaque, 3-nervia. Sepalum dorsale triangulari-ovatum, obtusum. Sepala lateralia oblongo-lanceolata, obtusa. Petala deltoidea, obtusa, margine postico fere recto, margine antico medio triangulariter dilatato minute ciliolato, labellum basi saccatum, apici bilobum, sacco suborbiculari intus appendicibus 2 cornuformibus recurvis donato, lamina oblonga marginibus basi incurvis carnosis super medium in lobos 2 divaricatos oblongo-obovatos inconspicue retusos instructa papillosa.

Stem shortly creeping at the base and rooting at the nodes, remainder erect, leafy, slender, green, up to c. 16 cm. long, internodes up to c. 3.40 cm. long. Leaves c. 5, ovate or ovate-lanceolate, acute, green, 1-2.80 cm. long, .70-1.15 cm. wide, petiole grooved together with the tubular sheath c. 1.10 cm. long. Inflorescence erect, slender, green laxly white-hairy, laxly 5-10-flowered, peduncle up to c. 8 cm. long provided with 2 ovate acuminate acute sheaths, rachis up to c. 4 cm. long. Bracts ovate, acuminate, acute, hairy and papillose outside, very pale flesh colour, c. .70 cm. long. Sepals hairy and papillose outside, 3-nerved. Dorsal sepal triangular-ovate, obtuse and cucullate at the apex, green tipped white, c. .52 cm. long, c. .40 cm. wide. Lateral sepals oblong-lanceolate, obtuse and cucullate at the apex, keeled outside, green, c. .47 cm. long, c. .18 cm. wide. Petals agglutinate with the dorsal sepal into a hood, deltoid, very shortly triangular-acuminate, obtuse and hooded at the apex,

posterior margin nearly straight, anterior margin roundly triangularly dilate in the middle and minutely ciliolate, 2-nerved, outside grooved and papillose except near the posterior margin, white, c. .50 cm. long, c. .18 cm. wide. Lip saccate at the base, bilobed at the apex, spread out c. .52 cm. long, c. .55 cm. wide, white; sac suborbicular, margins appressed to the column, provided inside with 2 horn-like recurved appendages, c. .17 cm. long; blade oblong with the margins at the base incurved and fleshy, dilate at the apex to 2 diverging oblong-obovate inconspicuously retuse lobes which form an obtuse angle with each other, c. .35 cm. long, c. .55 cm. wide across the apex of the lobes, papillose, lobes c. .27 cm. long c. .19 cm. wide. Column green, c. .26 cm. tall, provided in front with 2 lower extrorse papillose lamellæ which are produced at the base to a short triangular lobe, rostellum bifid with the lobes dilate below the apex provided beneath at the base with a papillose cushion, stigmata 2 oblong or suborbicular elevate wrinkled. Anther cordate, acuminate, acute, c. .24 cm. long, c. .15 cm. wide. Pollinia 2, pyriform, caudicle linear, disc triangular.

A slender plant of the affinity of *Z. gracilis* Bl. but readily distinguished by the larger flowers with hairy and papillose sepals and the papillose petals with the anterior margin minutely ciliolate.

C. 3159, SFN 26671, terrestrial by the Kadamaian river in the neighbourhood of Menetendok Gorge c. 2,800 feet, March, 1933.

Described from dried material and flowers preserved in spirit.

Hetæria angustifolia sp. nov. Caulis basi radicans. Inflorescentia pilosa. superne foliosus. pauciflora. Bracteæ late ovatæ, breviter acuminatæ, acutæ, extus Sepala extus pilosa, ovata, obtusa, lateralibus Petala glabra, e basi brevissime unguiculata, obovata, obtusa, extus canaliculata, margine postico recto, margine antico late rotundatim dilatato. Labellum saccatum, 3-lobum, sacco intus carinato basin versus appendicibus 2 cuneatis vel oblongis truncatis vel inconspicue retusis donato, lobis lateralibus brevibus rotundatis, lobo intermedio oblongo brevissime bilobulo breviter puberulo concavo. Gynostemium breve, intus lamellis 2 parallelibus altis donatum.

Stem rooting at the base, leafy above, c. 13 cm. long, internodes up to c. 2 cm. long. Leaves lanceolate, acute, grooved above, keeled beneath, dark green with a median pink line, up to c. 5.25 cm. long, c. .80 cm. wide, base narrowed to a petiole up to c. .50 cm. long, sheath tubular c. .80 cm. long including the free apex. Inflorescence

shortly hairy, laxly few-flowered, peduncle c. 2 cm. long provided above the base with a short tubular sheath, rachis c. 5 cm. long. Bracts broadly ovate, shortly acuminate, acute, hairy outside, 1-nerved, c. .60 cm. long, c. .43 cm. wide. Sepals hairy outside, ovate, obtuse, 1-nerved, the laterals falcate, olive, .37-.42 cm. long, c. .25 cm. wide. *Petals* cohering to the dorsal sepal in the form of a hood, glabrous, base minutely clawed, blade obovate obtuse, grooved outside, posterior margin nearly straight, anterior margin roundly dilate, white, c. .37 cm. long, c. .20 cm. wide. Lip saccate, 3-lobed, grooved beneath, sac shallow keeled inside with the keel dilate to a conic tubercle in the upper half and provided near the base with 2 cuneate or oblong forward-pointing fleshy appendages with truncate or inconspicuously retuse apex, spread out in all c. .47 cm. long, c. .40 cm. wide, sac red; side lobes erect, white, very short, rounded, forming with the sac a subquadrate hypochile which is a little narrowed in the middle; midlobe oblong, shortly roundly bilobed, a little contracted in the middle, shortly puberulous, concave inside, grooved outside, wnite, c. .13 cm. long. Column c. .20 cm. tall, clavate-dilate from a narrow base, bilamellate in front, the lamellæ tall parallel oblong with rounded apex and truncate base and a transverse keel outside above the base. *Anther* broadly ovate, shortly acuminate, acute, c. .15 cm. long.

This is nearest to H. purpurascens Bl. from Java but it differs in the details of the lip and in the very large lamellæ of the column.

C. 3770 Main spur above Koung c. 2,500 feet, December, 1933.

Described from a dried plant and flowers preserved in spirit.

Cystopus Hasseltii Bl. Fl. Jav. Orch. 72, t. 30, f. 3. t. 36 B.

C. 3736, SFN 28055, near Tenompok c. 5,000 feet, August, 1933.

Distribution:—Java.

Macodes Petola Lndl. Gen. & Sp. Orch. (1840), 497.

C. 3334, Mahandui river on Penibukan Ridge c. 3,500 feet, April, 1933.

Distribution:—Java, Sumatra, Malay Peninsula, Philippines.

Macodes angustilabris J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. XI (1931), 90.

C. 3491, near Bundu Tuhan c. 4,000 feet, June, 1933.

Distribution:—Dutch Central East Borneo.

Dicerostylis kinabaluensis sp. nov. Caulis elongatus. validus. Folia ad c. 7. oblongo-lanceolata vel oblongooblanceolata, breviter acuminata, acuta. Inflorescentia dense multiflora. Bracteæ late lanceolatæ, acuminatæ, acutæ, extus pilosæ. Sepala ovata, breviter acuminata, anguste obtusa, lateralibus latioribus margine antico basi rotundatim producto, extus pilosa. Petala e basi angusta ovata, breviter acuminata, acuta, extus sulcata dimidio inferiore breviter laxe pilosa. Labellum integrum, saccatum, sacco magno inflato subgloboso extus bicarinato inter carinas sulcato intus medio fere carinis brevibus 6 apici in tuberculam parvam erectam elevatis, lamina recurva subulata sulcata.

Stem with the base prostrate with 1-3 stout villose roots from each node, remainder erect stout leafy towards the apex, up to c. 64 cm. long, internodes c. 3 cm. long. Leaves c. 7, oblong-lanceolate or oblong-oblanceolate, shortly acuminate, acute, dark green, 8.50-13 cm. long, 3-5 cm. wide, petiole grooved together with the loosely tubular sheath up to c. 3.50 cm. long. Inflorescence erect, densely many-flowered, peduncle up to c. 3 cm. long hairy, rachis hairy c. 9 cm long. Bracts broadly lanceolate, acuminate, acute, 3-nerved, hairy outside, c. 1.70 cm. long, c. .58 cm. wide. Sepals 3-nerved, hairy outside. Dorsal sepal ovate, shortly acuminate, narrowly obtuse, olive suffused dull red in the upper ½, c. 1.08 cm. long, c. .58 cm. wide. Lateral sepals subfalcate, ovate, shortly acuminate, narrowly obtuse, strongly reflexed from the base, anterior margin roundly produced at the base, apex recurved, olive tipped dull red, c. 1.08 cm. wide, c. .70 cm. wide. Petals ovate from a narrow base, shortly acuminate, acute, 3-nerved, grooved outside and shortly laxly hairy below the middle of the anterior ½, rose-red, c. 1.08 cm. long, c. .50 cm. wide. Lip entire, saccate at the base, in all c. .70 cm. long; sac subglobose, dilate on the sides and inflated, provided outside with 2 keels separated by a groove, 6 low short keels inside about the middle ending in a small erect tubercle, bright yellow, c. .60 cm. long and as broad; blade recurved, subulate, grooved, rose-red, c. .50 cm. long, c .15 cm. wide. Column shortly adnate at the base to the margins of the sac of the lip, dilate upwards, c. .80 cm. long, c. .25 cm. wide, keeled in front with the keel ending below the stigma in 2 triangular extrorse teeth, clinandrium oblong margins erect with a minute tooth below the middle, rostellum oblong triangular-acuminate from about the middle with recurved

margins the apex provided with a minute tooth grooved beneath, stigma crescent-shaped. *Anther* oblong, triangular-acuminate, acute, keeled, base bilobed, c. .70 cm. long, c. .20 cm. wide. *Pollinia* grooved, pyriform, disc narrowly elliptic, in all c. .60 cm. long

C. 3614, SFN 27861, near Bundu Tuhan c. 3,000 feet, July, 1933.

Clemens 29877, Tenompok 5,000 feet, June 13th, 1932.

Described from dried material and flowers preserved in spirit.

Lepidogyne longifolia Bl. Fl. Jav. n. ser. I (1858), 78. t. 25.

C. 3137, SFN 27951, near Kiau c. 3,000 feet, March, 1933.

Clemens 27725, Dallas 3,000 feet, December 31st, 1931; 29898, Tenompok 5,000 feet, June 13th, 1932.

Distribution:—Java, Sumatra, Malay Peninsula, Philippines, ? N. Guinea.

Goodyera kinabaluensis Rolfe in Gibbs in Journ. Linn. Soc. xlii (1914), 159.

C. 3179, SFN 27337, Menetendok c. 3,000 feet, March, 1933. Leaves very dark velvety green with margins, 5 nerves and reticulation rose-red, rose-lilac beneath; C. 3419, SFN 27337 between Kelawat and Koung c. 2,500 feet, May, 1933. Leaves dark green with red nerves and reticulation above, lilac beneath, sheaths pale rose. Inflorescence pale green. Bracts pink. Sepals dark olive suffused rose-red especially towards the apex. Column pale yellow, appendages white with a green spot at the base. Anther pale red-brown.

Clemens 27695, Dallas 3,000 feet, December 30th, 1931. Distribution:—Endemic.

Goodyera rubicunda Lndl. in Bot. Reg. XXV (1839), Misc. 61.

C. 3757, SFN 28054, near Dallas c. 3,000 feet, August, 1933.

Clemens 26308, Dallas 3,000 feet, September 4th, 1931; 26896, Dallas 3,000 feet, November 1931; 26997, Dallas 3,000 feet, November 6th, 1931.

Distribution:—Java, Sumatra, Malay Peninsula, Dutch Borneo, Celebes, Philippines, Amboina, Moluccas, N. Guinea.

Goodyera rosans J. J. S. in Bull. Jard. Bot. Buit. Ser. 3. IX (1927), 34, t. 3, f. IV.

C. 3572, SFN 27977, near Koung c. 1,400 feet, June, 1933.

Distribution:—Java.

Goodvera ustulata sp. nov. Planta pusilla. Caulis basi breviter repens, ceterum erectus. Folia c. 4, leviter obliqua, oblongo-ovata, breviter acuminata, acuta vel anguste obtusa. Inflorescentia erecta, laxe multiflora. Bracteæ ovatæ, acuminatæ, acutæ, extus pilosæ. marginibus ciliolatis. Sepalum dorsale ovatum, acuminatum, obtusum, extus clavatopilosum. lateralia basi falcata, ovata, acuminata, obtusa, extus clavato-pilosa. Petala e basi longe unguiculata ovata, obtusa, ungui cuneato, laminæ marginibus irregulari-Labellum integrum, basi saccatum, sacco transverse elliptico intus nonnullis fascibus muricium donato, lamina ovata acuminata obtusa basi in tuberculas 2 approximatas instructa tuberculis apici in carinam brevem inconspicuam productis.

A small plant, c. 11 cm. tall. Stem very shortly creeping at the base and emitting a stout villose root from each node, remainder erect rather stout, pinkish purple, up to c. 7.50 cm. long, internodes up to 1 cm. long. Leaves c. 4, a little oblique, oblong-ovate, shortly acuminate, acute or narrowly obtuse, green above but dark green often suffused purplish towards the margins with 5 nerves and reticulation silver, purplish beneath with the median line green, 1.50-6.75 cm. long, .66-2.85 cm. wide, petiole grooved together with the tubular sheath up to c. 2 cm. long. Inflorescence erect, laxly many-flowered, hairy, pinkish purple, peduncle up to c. 1 cm. long with 1-2 large sheaths, rachis c. 4 cm. long. Bracts ovate, acuminate, acute, hairy on the back, margins ciliolate, pinkish purple, c. 1 cm. long, the upper ones Sepals clavate-hairy outside, ochre suffused dull red except at the base and the pure white apex. *Dorsal* sepal ovate, acuminate, obtuse, 1-nerved, c. .40 cm. long, c. .25 cm. wide. Lateral sepals falcate at the base, ovate, acuminate, obtuse, 3-nerved, c. .43 cm. long, c. .25 cm. wide. Petals cuneately clawed to beyond the middle, blade ovate obtuse with irregular margins, agglutinate with the dorsal sepal in the form of a hood, white, 1-nerved, c. .40 cm. long, c. .18 cm. wide. Lip entire, saccate at the base, 3-nerved, cream with pure white apex, spread out c. .35 cm. long, c. .22 cm. wide, sac transversely elliptic with margins erect and appressed to the column shallow provided inside with groups of murices, blade ovate acuminate obtuse grooved provided at the base with 2 small tubercles which are produced to short inconspicuous keels not reaching the apex. Column cream, c. .30 cm. long, rostellum bifid grooved beneath, stigma transversely oblong much elevate beneath.

C. 3236, SFN 27359, Ulu Kagitang c. 3,500 feet, terrestrial in very young secondary forest, April, 1933.

Clemens 26911, Dallas 3,000 feet, November 2nd, 1931; 26690a, Dallas 3,000 feet, October 2nd, 1931.

This plant is of the affinity of *G. pusilla* Bl. and *G. reticulata* Bl. from which it differs in the hairy sepals, the lip with a shallower sac and 2 small tubercles at the base of the blade and in the longer rostellum.

Described from dried material and flowers preserved in spirit.

Goodyera procera Hook. Exot. Fl. I (1823), t. 39.

C. 3509, SFN 27470, Kamborangah c. 7,200 feet, terrestrial in light woods, June, 1933.

Clemens s.n. Kamborangah 8,000 feet, March 24, 1932; s.n. below Lumu Lumu along forest trail in moss-covered rocks, January 10th, 1932.

Distribution:—Java, Sumatra, India, China, Japan.

Goodyera hylophiloides sp. nov. Caulis basi repens, ceterum erectus. Folia c. 4, obliqua, elliptica vel elliptico-lanceolata, acuminata, acuta. Inflorescentia erecta, elongata, subdense pluriflora. Bracteæ ovatæ, longe acuminatæ, acutæ, marginibus sparse ciliatis. Sepalum dorsale late ellipticum, acutum, glabrum. Sepala lateralia majora, falcata, late ovata, subacuta. Petala e basi longe cuneato-unguiculata triangulariovata, subacuta, marginibus apicem versus erosulis. Labellum trilobum, lobis lateralibus erectis triangularibus obtusis, lobo intermedio ovato obtuso, intus basin prope appendicibus c. 4 erectis oblongis carnosis rugosis donatum.

Stem creeping at the base and emitting a long stout villose root from each node, remainder erect leafy, up to c. 15 cm. long, internodes c. 1 cm. long. Leaves c. 4, oblique, elliptic or elliptic-lanceolate, acuminate, acute, green with darker nerves, 6.33-9.33 cm. long, 1.55-2.90 cm. wide, petiole grooved up to c. 2.75 cm. long, sheath tubular with a long oblique apex up to c. 2 cm. long. Inflorescence erect, elongate, rather densely very many-flowered, peduncle terete glabrous provided with 3-4 large sheaths with a tubular base and many bract-like appressed sheaths below the rachis up to c. 28 cm. long, rachis shortly hairy up to c. 14.50 cm. long. Bracts spreading, ovate, long-acuminate, acute, margins sparingly ciliate, remainder glabrous, 1-nerved, c. .40 cm. long, c. .14 cm. wide. Flowers minute with the ovary at right angles to the rachis. Sepals glabrous, 1-nerved, the laterals keeled on the back, green tipped white.

Dorsal seval broadly elliptic, acute, c. .19 cm. long, c. .16 cm. wide. Lateral sepals falcate, broadly ovate, subacute, c. .20 cm. long, c. .17 cm. wide. Petals agglutinate with the dorsal sepal into a hood, strongly oblique, subfalcate, cuneately clawed to well beyond the middle, blade triangularovate subacute with margins minutely erose, 1-nerved, c. .19 cm. long, c. .08 cm. wide, white with a greenish base. Lip distinctly 3-lobed, 1-nerved, ventricose, provided inside near the base with c. 4 erect oblong fleshy wrinkled appendages with truncate or inconspicuously toothed apex, yellow-green tipped white, spread out c. .23 cm. long and as wide across the side lobes, side lobes erect and embracing the column triangular obtuse, midlobe much smaller ovate obtuse with margins irregular or minutely erose. Column c. .13 cm. tall, abruptly dilate towards the apex, rostellum very shortly bilobed, stigma transversely oblong. Anther cordate, obtuse, keeled above, shortly bidentate above the base, c. .07 cm. long. Pollinia 2, pyriform, grooved.

This species is closely related to *G. procera* Hook. from which it is at once distinguished by the much smaller flowers, narrower petals and different lip and column. From *G. parviflora* Bl., which Dr. J. J. Smith considers to be a peloric state of *G. procera* Hook. and to which the present plant appears to be nearest, it differs *i.a.* in the distinctly 3-lobed lip with c. 4 conspicuous basal appendages.

C. 3256, SFN 26939, Main Spur of the mountain above Tenompok c. 5,200 feet, April, 1933.

Clemens 29993, Silau basin and trail to Lumu Lumu 6,000 feet, May and June, 1932; s.n. Dallas 3,000 feet, December 17th, 1931.

Described from dried material and flowers preserved in spirit.

Tropidia? pedunculata Bl. Fl. Jav. Orch. n. ser. I (1858), 105, t. 42 E; t. 43, f. 1.

C. 3764, Near Dallas c. 3,000 feet, May, 1933.

Distribution:—Sumatra, Duizend Is., Timor Laut, Moluccas, ? N. Guinea.

Corymborchis veratrifolia Bl. Fl. Jav. Orch. 105, t. 42 E, t. 43, f. 1.

C. 3218, SFN 27310, below Lobang c. 3,800 feet, April, 1933.

Clemens 26800, Dallas 3,000 feet, November 24th, 1931.

Distribution:—Sumatra, Java, Malay Peninsula, Moluccas, N. Guinea.

Gardens Bulletin, S.S.

Chrysoglossum reticulatum sp. nov. Pseudobulbi anguste cylindrici, apicem versus angustati, 1-folii. Folium lanceolatum, acuminatum, acutum, petiolo elongato. Inflorescentia basi pseudobulbi orta, elongata, laxe multiflora. Bracteæ late ovatæ, brevissime acuminatæ, acutæ, intus stellato-pubescentes. Sepalum dorsale lineare, obtusum, sæpe minute apiculatum. Sepala lateralia gynostemii pedem decurrentia, leviter falcata, lineari-oblanceolata, obtusa, margine antico basi leviter dilatato. Petala e basi oblique cuneata oblongolanceolata, obtusa, falcata. Labellum 3-lobum, apici pedis gynostemii elastice insertum, basi unguiculatum, carinis 3 sub medio lobi intermedii evanescentibus exterioribus basi rectis medio valde undulatis sub apice in formam lamellæ semiorbicularis dilatatis intermedio omnino recto apici furcato, ungui transverse oblongo plica magna pilosa utringue, lobis lateralibus breves semiorbicularibus, lobo intermedio cuneato-obovato brevissime retuso cum apiculo minuto in sinu.

Pseudobulbs approximate or subapproximate, erect, narrowly cylindric, tapering towards the apex, covered at first with large membraneous sheaths, 3-4 cm. long, 1-leaved. Leaf lanceolate, acuminate, acute, rather thin in texture with 5 strong nerves, green, up to c. 22.50 cm. long, 2.40-4.50 cm. wide, petiole slender grooved up to c. 22 cm. long. Inflorescence erect from the base of the pseudobulb, laxly many-flowered, peduncle terete with some large membraneous sheaths at the base and 2-3 smaller sheaths at intervals above up to c. .52 cm. long, rachis up to c. 30 cm. long. Bracts broadly ovate, very shortly acuminate, acute, 5-nerved, stellate-pubescent inside, pale yellow with green nerves, c. .93 cm. long, c. .63 cm. wide. Sepals and petals keeled outside with the nerves and reticulation elevate, the sepals warty outside towards the apex, pale yellow thickly transversely spotted pale purple except at the apex. Dorsal sepal linear, obtuse, often minutely apiculate, distinctly but inconspicuously dilate at c. a third above the base, 3-nerved and finely reticulate with transverse nervelets, c. 2 cm. long, c. .35 cm. wide. Lateral sepals running down the column foot, subfalcate, linear-oblanceolate, obtuse, anterior margin a little dilate at the base, nerves similar to those of the dorsal sepal, c. 1.93 cm. long, c. .40 cm. wide. Petals shortly adnate to the column foot, falcate at the obliquely cuneate base, oblong-lanceolate, obtuse but often with a minute apiculus, 3-nerved with the outer nerves branched above the base and very finely reticulate with transverse nervelets, c. 1.55 cm. long, c. .60 cm. wide. Lip 3-lobed, mobile, clawed at the base, provided with 3 keels which

reach to below the middle of the midlobe, the outer keels not reaching the base of the lip straight and a little diverging at the base then strongly undulate and sinuous and dilate below the straight apex into a semiorbicular lamella, median keel shorter straight, apex branched rugulose, spread out c. 1.10 cm. long, c. .77 cm. wide across the side lobes; claw transversely oblong with a large hairy fold on each side, white, .25 cm. long, c. .38 cm. wide; side lobes short, forming nearly a right angle with the blade, semiorbicular, white with a short brown steak at the base, c. .25 cm. long and as broad; midlobe cuneate-obovate, apex rounded very shortly retuse with a minute tooth in the sinus, fleshy. concave with suberect margins, c. .55 cm. long, c. .50 cm. wide, pure white spotted deep lilac inside the margins and with a large transverse dark lilac spot at the base. Column abruptly, almost right angularly curved about the middle. sides dilate below the stigma into a minute tooth, provided below the middle with 2 approximate large roundly triangular lamellæ with the anterior margin produced at the base to the apex of the column foot, a triangular acuminate acute process on each side below the apex of the lamellæ, yellow, c. .90 cm. tall, clinandrium triangular with minutely erose margins, stigma broadly ovate. transversely semielliptic with a short triangular tooth at the apex, a low boss above, bright yellow, c. .09 cm. long, c. .15 cm. wide. *Pollinia* 2, conic, c. .05 cm. long. foot forming an obtuse angle with the base of the column, a little incurved towards the apex, c. .30 cm. long, excavate in the lower ½ into the form of a subglobose spur which is rather flattened and grooved on the back and constricted at the mouth with the entrance very narrow between the base of the column lamellæ c. .14 cm. tall c. .18 cm. across.

A near ally of *C. ornatum* Bl. but distinct by reason of the smaller leaves, the lip with hairy basal folds and different keels and the column with different appendages, the outer 2 being tooth-like and borne below the apex of the large lamellæ which are produced outwards to the apex of the column foot where the narrow entrance of the spurlike cavity of the foot is situated. The sepals and petals are very delicately reticulate-nerved with the nerves and reticulation elevate.

C. 3314, SFN 27060, Main spur West of Tenompok Pass c. 5,000 feet, April, 1933.

Clemens s.n. Tenompok, trail to Tomis 5,400 feet, May 2nd, 1932.

Described from dried material and flowers preserved in spirit.

Gardens Bulletin, S.S.

Tainia plicata Ridl. in Journ. Linn. Soc. Bot. XXXI (1896), 285. etc.

C. 3158 Menetendok gorge c. 2700 feet, March, 1933. Distribution:—Java.

Tainia purpureifolia sp. nov. Pseudobulbi cylindrici, 1-folii. Folium ovatum vel ovato-lanceoabrupte acuminatum, acutum, marginibus minutissime undulatis. Inflorescentia basi pseudobulbi orta, gracilis, laxe c. 2-flora. Bracteæ ovatæ, acutæ. Sepalum dorsale anguste oblongum, obtusum. Sepala lateralia falcata, anguste oblongo-lanceolata, obtusa. Petala falcata, oblongo-lanceolata, subacuta. Labellum breviter unguiculata abrupte dilatatum, integrum, oblongum, subpanduratum, breviter acuminatum, anguste obtusum, intus super basin carinis 3 intermedia humiliore apicem attingente exterioribus brevioribus altioribus apicem versus decrescentibus.

Rhizome shortly creeping, slender. Pseudobulbs c. 1 cm. distant, forming an acute angle with the rhizome, cylindric, entirely concealed by a large membraneous sheath which reaches to the apex of the leaf petiole, c. 1.50 cm. long, 1-leaved. Leaf ovate or ovate-lanceolate, abruptly acuminate, acute, slightly rigid, margins very minutely and finely undulate, very dark green above, purple beneath, up to c. 5 cm. long, c. 2 cm. wide, petiole grooved c. 1 cm. long. Inflorescence from the base of the pseudobulb, slender, erect, very laxly c. 2-flowered, peduncle terete with some short tubular sheaths at the base and 1-2 longer ones above up to 18.50 cm. long, rachis up to c. 4.50 cm. long. Bracts appressed to the pedicel, ovate, acute, 5-nerved, lower one larger c. 1.10 cm. long. Flowers not widely expanded, sepals and petals keeled on the back with 2 raised nerves yellow suffused purple down the middle. Dorsal sepal narrowly oblong, obtuse, inconspicuously dilate at c. a third above the base, 3-nerved with the outer nerves branched from the base, c. 1.25 cm. long, c. .23 cm. wide. Lateral sepals adnate to the column foot, falcate, narrowly oblonglanceolate, obtuse, 3-nerved with the outer nerves branched from the base, c. 1.25 cm. long, c. .25 cm. wide. *Petals* falcate, oblong-lanceolate, subacute, 3-nerved with the outer nerves branched from the base, c. 1.10 cm. long, c. .28 cm. Lip entire, abruptly dilate from the shortly clawed wide. subpandurate, very shortly acuminate. oblong, narrowly obtuse, provided with 3 keels from above the base the median one low reaching to the apex the laterals shorter and taller tapering towards the apex waved above the base. white with a pale purplish tinge, purple in the upper half, suffused purple beneath along the middle, the margins in

the upper $\frac{1}{2}$ strongly incurved and imbricating, spread out c. 1.07 cm. long, c. .52 cm. wide. Column white with a large dark purple spot on the back at the apex, c. .55 cm. tall, c. .22 cm. wide, clinandrium transversely oval with inconspicuously 3-lobed margins, stigma transversely oblong retuse. Anther conic, grooved on the back, shortly bilobed at the base, beak short triangular truncate, cream. Column foot abruptly and c. rightangularly incurved, the apex ending in 2 divaricate fleshy extrorse lobules, c. .15 cm. long.

This is a close ally of *T. vegetissima* Ridl. from the Malay Peninsula but that species is larger with a broadly obovate apiculate lip with 2 very short thin basal keels and elevate nerves. Both species are characterised by the small pseudobulbs, the small leaves which are either entirely red or red-purple or with the under-surface so coloured and an entire lip. It seems to me more natural to segregate these plants under a special section for which I propose the name Chromatophyllon.

C. 3150, SFN 26597, Gurulau Spur c. 4,600 feet, terrestrial in moss or humus, March, 1933.

Described from dried material and flowers preserved in spirit.

Nephelaphyllum verruculosum Pseudobulbi nov. sp. breves, 1-folii. Folium obliquum, e basi truncata vel subcordata ovatum, breviter acuminatum, acutum. Inflorescentia folio subæquelonga, apici dense multiflora. Bracteæ late ovato-oblongæ, acuminatæ, acutæ. Sepala petalaque e basi reflexa. Sepalum dorsale anguste oblongo-oblanceolatum, brevissime acumina-Sepala lateralia longiora, angustiora, tum, acutum. falcata, lineari-oblanceolata, acuta, cuspidata. oblongo-oblanceolata, leviter falcata, obtusa Labellum integrum, calcaratum; lamina subacuta. elliptica, haud unguiculata, subretusa, basi pilosa, exceptis omnino puberulo-verruculosa, marginibus apicem versus lineas 3 verrucarum densarum ferens; calcar oblongum, extus sulcatum, intus carinatum faucem versus dense pilosum.

Rhizome creeping. Pseudobulbs up to 3 cm. distant, forming an acute angle with the rhizome, cylindric, dark olive spotted purple, c. 1.50 cm. long, 1-leaved. Leaf ovate from the truncate or subcordate base, shortly acuminate, acute, oblique, brown reticulate dark brown with bright green nerves above, purple beneath, 3-9 cm. long, 1.90-6.70 cm. wide, petiole grooved dark olive suffused purple towards the apex c. 1 cm. long. Inflorescence erect from the base

of the pseudobulb, densely many-flowered, peduncle terete with some tubular sheaths at the base and c. 2 bract-like ones at intervals above dark olive spotted purple up to c. 6.50 cm. long, rachis c. 4 cm. long. Bracts broadly ovate-oblong, acuminate, acute, c. .80 cm. long. Flowers small for the genus, widely expanded with the sepals and petals reflexed from the base green with indistinct purple nerves. Dorsal sepal narrowly oblong-oblanceolate, very shortly acuminate, acute, 1-nerved, c. .82 cm. long, c. .20 cm. wide. Lateral sepals longer and narrower, falcate, linear-oblanceolate, acute, cuspidate, 1-nerved, c. .95 cm. long. c. .17 cm. Petals slightly falcate, oblong-oblanceolate, obtuse or subacute, 2-nerved, c. .78 cm. long, c. .20 cm. wide. entire, spurred, 5-nerved, white with an orange median bar in the upper third, spread out c. 1.37 cm. long including the spur, c. .67 cm. wide across the middle of the blade; blade not clawed, elliptic, subretuse, densely hairy at the base, covered except near the margins with puberulous warts, provided at the apex with 3 short lines of dense warts, c. 1 cm. long; spur oblong, grooved on the back and on the front in the upper 1/2, keeled inside and densely hairy near the mouth, green, c. .37 cm. long, c. .23 cm. diam. Column winged for the whole length, the wings thin and broad a little dilate towards the rounded apex and ending in a very short tooth, white suffused purple at the apex, c. .53 cm. tall, c. .45 cm. wide, clinandrium deeply excavate transversely oblong with the posterior margin produced to a triangular lobe, rostellum very short transversely oblong, stigma large ovate. Anther shortly and broadly ovate, concave in front with a median keel, grooved above the base, margins elevate in front and terminating towards the base in 2 divergent bosses, lilac, c. .17 cm. long, c. .23 cm. wide. Ovary rather strongly 6-ribbed, furfuraceous, c. .30 cm. long, pedicel terete c. .45 cm. long.

This plant is closely related to *N. borneense* Schltr. from which it is at once distinguished by the lip which is elliptic, not at all clawed and entirely warty except near the margins and by the column which is very broadly winged throughout.

C. 3160, SFN 26607, Menetendok/Kinataki Divide c. 3,000 feet, March, 1933.

Described from dried material and flowers preserved in spirit.

Nephelaphyllum latilabre Ridl. in Stapf in Trans. Linn. Soc. Ser. iv (1894), 238.

C. 3254, SFN 26938, main spur above Tenompok c. 5,200 feet, April, 1933. Sepals and petals green with 3 purple nerves. Lip white with radiating bright purple

nerves, keels bright purple in the lower half deep orange in the upper half. Column base green, apex white, sides purple, 2 purple streaks inside below the stigma. Anther deep creamy yellow with a purple tip on each boss. Leaves green or brown spotted darker and with 5 dark green nerves, purple beneath, petiole and stem green spotted purple. A most beautiful plant.

Clemens 27806, below Lumu Lumu in wet mossy place c. 5,500 feet, January 10th, 1932; 29119 Lumu Lumu 6,000 feet, April 1st, 1932; s.n. Lumu Lumu 6,000 feet, March 23rd, 1932; s.n. trail to Lumu Lumu 5,500 feet, June 4th, 1932.

Distribution:—Endemic.

Mischobulbum scapigerum Schltr. in Fedde Rep. Beih. 1 (1911), 98; Nephelaphyllum scapigerum Hook. f. Bot. Mag. (1863), t. 5390.

C. 3420 between Kelawat and Koung c. 2,500 feet, May, 1933. Sepals and petals deep ochre (semitransparent) veined darker. Lip lower half purple with pale yellowish margins, upper half ochre with darker nerves, keels purple in the lower half ochre in the upper half. Column pale yellow with purple base, foot purple with cream apex. Anther pale yellow.

Clemens s.n. Dallas 3,000 feet, December 4th, 1931. Distribution:—Endemic.

Cœlogyne cuprea Wendl. & Krzl. in Gard. Chron. ser. 3. XI (1892), 619.

C. 3075, SFN 26454, Ulu Mahandui, Penibukan Ridge, c. 4,000 feet, March, 1933.

Clemens 26518, Dallas 3,000 feet, September 21st, 1931; 28294, (mixed with *C. monilirachis* Carr) Tenompok 5,000 feet, February 9th, 1932; s.n. Tenompok 4,000 feet, August 21st, 1931; s.n. Tenompok 5,000 feet, February 19th, 1932; s.n. Tenompok 5,000 feet, October 12th, 1931.

Distribution:-Sumatra.

Cœlogyne (§ Longifoliæ) planiscapa Carr

var. grandis var. nov. A planta typica statura multo majore differt.

This new variety differs from the typical plant, with which it may also be found growing, by the much larger dimensions. Pseudobulbs up to 8 cm. distant and 13 cm. long. Leaves oblong-oblanceolate, shortly acuminate, acute, rigid, coriaceous, 33-46 cm. long, 4-7 cm. wide, petiole grooved c. 7.50 cm. long. Inflorescence elongate, peduncle very strongly flattened up to 30 cm. long c. .80 cm. wide at the base c. .20 cm. thick, rachis conspicuously flexuous with

internodes up to 1.50 cm. long .30 cm. diam. Dorsal sepal $4-4.50\times1.20-1.75$ cm. Lateral sepals $4-4.30\times1.05-1.40$ cm. Petals $3.70-4\times.25-.28$ cm. Lip when spread out $3.65-3.80\times1.60-2.20$ cm. across the side lobes, midlobe $2.27-2.30\times1.20-1.80$ cm. Column 2.20-2.30 cm. tall.

Sometimes there is a pair of short lamellæ near the margins at the base of the midlobe while the median nerve of the lip is sometimes elevate near the apex. On Mount Kinabalu the variety is much more common than the typical plants.

C. 3120, SFN 27464, Penibukan ridge c. 4,500 feet, March, 1933. Sepals and petals salmon pink tinged with orange. Lip deep salmon pink. Column white tinged pale salmon; Kamborangah c. 6,200 feet, June, 1933.

Clemens s.n. above Lumu Lumu on rocky place 6,000 feet, November 15th, 1931.

Cœlogyne kinabaluensis A. & S. Orch. VI (1920), 33.

C. 3328, SFN 27361, below Lumu Lumu c. 5,200 feet, April, 1933. Sepals pale flesh with a yellow-green keel outside. Petals pale yellowish. Lip pale rose-salmon, keels bright ochre-yellow along the summit. Column pale pinkish salmon, darker near the whitish apex, base whitish. Anther cream with a yellow beak and pale salmon boss.

Distribution:—Endemic.

Cœlogyne compressicaulis A. & S. Orch. VI (1920), 25.

C. 3499, SFN 27466, below Kamborangah c. 7,000 feet June, 1933. Sepals and petals olive-yellow suffused salmon towards the base. Lip blade pale salmon-pink, side lobes bright olive-yellow, midlobe olive-yellow suffused pale salmon towards the base, keels bright salmon. Column bright salmon pink. Anther salmon. Marei Parei c. 7,000 feet, June, 1933. Sepals and petals pale yellow tinted salmon at the base, the sepals with a yellow-green keel outside. Lip blade pale salmon, side lobes yellow tinted orange, midlobe salmon suffused pale orange-yellow in the middle, keels salmon the laterals tipped dull orange. Column white tinted pale salmon.

Distribution:—Endemic.

Cœlogyne (§ Longifoliæ) tenompokensis sp. nov. Pseudobulbi ovoidei vel oblongo-ovoidei, bifolii. Folia linearia ad lineari-oblanceolata, acuta. Inflorescentia foliis juvenilibus synantha, intervallis flores 1-2 gignens, multiflora. Bracteæ lanceolatæ, breviter acuminatæ, acutæ, caducæ. Sepala oblongo-lanceolata, acute apiculata, lateralibus angustioribus. Petala anguste subulata, longe acuminata, acuta. Labellum 3-lobum, 3-carinatum, carinis simplicibus apicem

versus dilatatis lateralibus medio fere lobi intermedii abrupte evanescentibue intermedia basin lobi intermedii attingente, lobis lateralibus brevibus latisque truncatis vel subretusis, lobo intermedio oblongo-elliptico obtuso minute papilloso marginibus undulatis.

Rhizome creeping, up to .60 cm. diam., internodes up to c. .50 cm. long. Pseudobulbs up to c. 2 cm. distant, ovoid or oblong-ovoid, rather strongly laterally flattened, up to 9.50 cm. long, 1.70 cm. wide, c. .50 cm. diam. when dry, Leaves lanceolate, linear-lanceolate or linear-2-leaved. oblanceolate, acuminate, acute, rather thin in texture, 9.75-29 cm. long, 1.3 cm. wide, petiole grooved up to c. 4 cm. long. Inflorescence from between the immature leaves. elongate, very many-flowered, peduncle nude strongly laterally flattened up to c. 20 cm. long c. .40 cm. wide, rachis sinuous up to more than 50-flowered c. 35 cm. long slender with internodes .25-.80 cm. long. Bracts at first imbricating at the apex of the rachis then caducous, lanceolate, shortly acuminate, acute. Flowers opening singly or in pairs at intervals, salmon pink with the keels of the lip tipped yellow-brown. Sepals oblong-lanceolate, acutely apiculate, inconspicuously keeled on the back, 7-nerved, c. 2.30 cm. long, c. .55 cm. wide, the laterals subfalcate narrower. Petals narrowly subulate, long acuminate, very acute, 1nerved, c. 2.10 cm. long. c. .07 cm. wide. Lip 3-lobed, provided with 3 simple keels which are dilate upwards the laterals terminating abruptly in the middle of the midlobe the median reaching to the base of the midlobe, spread out c. 2.05 cm. long, c. .93 cm. wide across the side lobes. side lobes short and broad with truncate or subretuse apex, midlobe oblong-elliptic minutely apiculate minutely papillose inside with undulate margins c. 1 cm. long c. .60 cm. Column c. 1.25 cm. tall, arms inconspicuously roundly dilate from about the middle, hood with irregular margins and truncate apex, rostellum roundly triangular very shortly acuminate obtuse incurved over the stigma keeled above, stigma semi-orbicular with the anterior margin elevate and recurved. Anther ovate with a short keel-like boss above, beak ovate retuse, pale yellow-brown. Ovary conspicuously 6-ribbed, c. .40 cm. long, pedicel terete c. .90 cm. long.

C. 3270, SFN. 27501, Main Spur above Tenompok c. 5,200 feet, April, 1933.

Clemens 27191, Tenompok 5,000 feet, November ? 10th, 1931; 29126, Tenompok 5,000 feet, ? date.

This species is very closely allied to *C. compressicaulis* A. & S. from Kinabalu but is readily distinguishable by

the slender rachis and the larger flowers with very narrow subulate petals and shorter median keel of the lip.

Described from dried material and flowers preserved in spirit.

Cœlogyne (? § Longifoliæ) obtusifolia sp. nov. Pseudobulbi ad c. 3.70 cm. dissiti, anguste ovoidei, bifolii. Folia anguste oblonga, obtusa. Inflorescentia foliis valde juvenilibus synantha, quam folia brevior, multiflora. Bracteæ caducæ, ovatæ, acutæ. Sepalum dorsale triangulari-ovatum, acuminatum, acutum. Sepala lateralia ovato-oblonga, acuta, subsigmoidea. Petala linearia, subacuta, medio leviter constricta. Labellum 3-lobum, in lamina bicarinatum carinis apici incurvis, lobis lateralibus rotundatis, lobo intermedio subquadrato breviter bilobulo dente minuto in sinu papilloso, marginibus erosulis.

Rhizome creeping, branched, stout, covered with fleshy tubular sheaths, c. .40 cm. diam., internodes c. .50-.80 cm. Pseudobulbs up to c. 3.70 cm, distant, narrowly ovoid, up to c. 6 cm. long, 2-leaved. Leaves narrowly oblong, broadly obtuse, rather thin in texture, keeled beneath, 9.50-17.50 cm. long, 1-1.80 cm. wide, petiole grooved 1.50-2.50 cm. long. Inflorescence appearing from between the tips of the very young leaves with the peduncle nude hardly exsert, but elongating to c. 9.50 cm. in fruit, rachis subflexuous up to c. 4.50 cm. long 10-15-flowered, internodes up to c. .50 cm. long. *Bracts* caducous, ovate, acute, up to c. 1.30 cm. long. Flowers sub-simultaneous. opening in rapid sequence with 5-6 open together, sepals and petals transparently pale yellow with a very pale salmon Dorsal sepal triangular-ovate, acuminate, acute, 5nerved, c. .90 cm. long, c. .45 cm. wide. Lateral sepals ovate-oblong, acute, subsigmoid, 5-nerved, keeled on the back, c. .87 cm. long, c. .37 cm. wide. Petals linear, subacute, a little narrowed in the middle, margins irregular towards the apex, 1-nerved, c. .80 cm. long, c. .07 cm. wide. Lip 3-lobed, blade parallel to the column 2-keeled from above the base to the base of the midlobe with the keels fleshy incurved at the apex, pale salmon with white midlobe, the converging keels pale salmon, spread out c. .80 cm. long, c. .58 cm. wide across the rounded side lobes; midlobe rightangularly recurved, subquadrate, very shortly bilobed with a minute tooth in the sinus, papillose, margins undulate and minutely erose, inner nerves inconspicuously elevate, c. .38 cm. long and as broad. Column brown, not winged, c. .57 cm. tall, clinandrium transversely oblong deeply conic-excavate, rostellum ovate acuminate obtuse erect, stigma semiorbicular with elevate margins, hood transversely oblong with the upper margin c. 4-toothed, base dilate.

This is a very characteristic plant which I have provisionally included under the section *Longifoliae* though in some respects it is rather different from most other species of the section. Thus the short inflorescence lasts but a short time, the first 5-6 flowers opening together, with the remainder opening as the first series wither, the peduncle elongates in fruit, the lip differs in the lobing and in the curiously incurved keels and the column is unwinged.

C. 3149, SFN 27897, below Bundu Tuhan c. 2,000 feet, July, 1933.

Clemens 26125, Tenompok 4,000 feet, August 21, 1931.

Described from dried plants and flowers preserved in spirit.

Cœlogyne (§ Longifoliæ) monilirachis sp. nov. Pseudobulbi anguste elongato-ovoidei, 1-folii. Folium ellipticum, breviter acuminatum, acutum, membranaceum. Inflorescentia ex apice pseudobulbi maturi, multiflora. Bracteæ caducæ, triangulari-ovatæ, acutæ. dorsale late oblongum, triangulari-acuminatum, brevissime apiculatum vel tridentatum, basi cymbiforme. Sepala lateralia subfalcate oblongo-lanceolata, minute apiculata. Petala lineari-lanceolata, subacuta. Labellum 3-lobum, basi saccatum, carinis 3 carnosulis integris exterioribus super basin lobi intermedii evanescentibus intermedia basin lobi intermedii attingente deinde usque ad apicem labelli in forma nervi elevati producta, lobis lateralibus brevibus latisque, lobo intermedio longe oblongo-unguiculato lamina suborbiculari retusa cum apiculo carnoso in sinu.

Rhizome creeping, c. .60 cm. diam., internodes very short up to c. .25 cm. long. Pseudobulbs c. 1.30 cm. distant, elongate-ovoid, up to c. 13.50 cm. long, 1-nerved. Leaf elliptic, shortly acuminate, acute, membraneous with c. 7 strong nerves, green often suffused red, up to c. 27 cm. long, c. 10 cm. wide, petiole grooved up to c. 1.50 cm. long. Inflorescence from the apex of the mature pseudobulb, elongate, more than 40-flowered, arched, peduncle nude very slender a little dilate towards the apex up to c. 17.50 cm. long, rachis dilate smooth and contracted at the nodes and resembling a necklace when fresh sinuous and wrinkled when dry up to c. 11 cm. long, internodes .20-.30 cm. long. Bracts at first imbricating at the apex of the rachis then caducous, triangular-ovate, acute, c. .75 cm. long, c. 1.10 cm. wide. Flowers opening singly or up to 4 together at long

intervals, the sepals and petals semitransparently pale salmon pink. Dorsal sepal broadly oblong, triangularacuminate, very shortly apiculate or tridentate and narrowly truncate, base cymbiform, keeled outside, 7-nerved, 2.90-3.60 cm. long, 1.55-1.75 cm. wide. Lateral sepals subfalcately oblong-lanceolate, obtuse, minutely apiculate, keeled outside, 7-nerved, anterior margin shortly incurved above the base, base cymbiform, 2.70-3.30 cm. long, 1-1.30 cm. wide. Petals narrowly linear-lanceolate, subacute. grooved inside, 3-nerved, 2.85-3.15 cm. long, .23-.37 cm. Lip 3-lobed, shortly saccate at the base, provided inside with 3 rather fleshy entire keels of which the outer terminate abruptly at the base or c. the middle of the claw of the midlobe the median reaching to the base of the midlobe thence continued as a raised nerve to the apex of the lip, pale pink with paler apex, spread out c. 2.50-2.75 cm. long, 1.55-1.68 cm. wide across the side lobes; side lobes erect, short, broad, rounded; midlobe provided with a long oblong claw, blade suborbicular retuse with a fleshy apiculus in the sinus margins minutely erose and sometimes undulate provided on each side with an oblique groove from the margin at the apex of the claw to the apiculus, 1.28-1.45 cm. long, c. .85 cm. wide. Column arched, pink, c. 2.15 cm. tall, arms a little roundly dilate from about the middle and ending in a very small recurved tooth, hood rounded minutely crenulate, rostellum triangular-ovate very shortly acuminate minutely retuse, stigma subquadrate with the anterior margin elevate and recurved. Anther subquadrate as seen from the front with a short rounded boss above, beak short triangular inconspicuously retuse, c. .28 cm. long, c. .27 cm. wide. Pollinia 4, obovate, flattened and grooved inside, c. .15 cm. long. Ovary conspicuously 6-ribbed, c. 1 cm. long, pedicel terete c. .70 cm. long.

This appears to be nearest to *C. harana* J. J. S. from Dutch West Borneo but it differs in the larger flowers and in the characters of the lip. It is best that the species of the affinity of *C. incrassata* Lndl. should be considered as members of a separate section having regard to the single large leaf and the very characteristic rachis of the inflorescence. The section could be called **Moniliformes** and comprises *C. incrassata* Lndl., *C. Naja* J. J. S., *C. harana* J. J. S., *C. crassiloba* J. J. S., *C. macroloba* J. J. S., *C. vermicularis* J. J. S., *C. kelamensis* J. J. S., and *C. tenuis*. With the exception of *C. incrassata* Lndl. which occurs in Java and Sumatra and possibly *C. vermicularis* J. J. S. which has been reported from Sumatra all the species are purely Bornean. *C. tenuis* Rolfe. is perhaps too near to *C. incrassata* Lndl.

C. 3366, SFN 27230, Tenompok c. 5,000 feet, May, 1933.

Clemens 28294, (mixed with *C. cuprea* Wendl. & Krzl.) Tenompok 5,000 feet, February, 9th 1932; 26127, Tenompok 4,000 feet, August 21 1931; 28316 Tenompok 5,000 feet, February 24th, 1932; 28454 Tenompok 5,000 feet, February 17th, 1932; 27166 Tenompok 5,000 feet, November 21st, 1931.

Described from dried material and flowers preserved in spirit.

- Cœlogyne pulverula T. & B. in Nat. Tijdschr. Ned. Ind. XXIV (1863), 306.
- C. 3005, SFN 26261, Koung at c. 1,250 feet altitude, February, 1933.

Clemens 26044, Dallas 3,000 feet, August 9th, 1931; 26521, Dallas 3,000 feet, September 21st, 1931.

Distribution:—Sumatra.

- Cœlogyne Dayana Rchb. f. in Gard. Chron. XXI (1884), II. 826. etc.
- C. 3714, near Bundu Tuhan c. 3,500 feet, August, 1933. Sepals and petals ochre-yellow. Lip white streaked brown. Distribution:—Malay Peninsula.
- Cœlogyne rhabdobulbon Schltr. in Notiz. Berl. viii (1921), 15.
- C. 3678, near Pinansak c. 2,500 feet, August, 1933. Sepals and petals white, the sepals suffused pale pink down the middle outside. Lip side lobes white, blade buff, midlobe white suffused deep buff at the base, keels white tipped buff. Column white suffused buff inside towards the base. Anther pale ochre. Bracts pale straw suffused dull rose-lilac towards the base.

The keels of the lip differ a little from those of the typical plant. They are entire, thin on the blade, a little dilate, erose and crenate on the midlobe.

Distribution:—Endemic.

- Cœlogyne Rochussenii De Vr. Ill. Orch. (1854), t. 2; t. 11, f. 6. etc.
- C. 3008, SFN 26264, Koung c. 1,250 feet, February, 1933 (fruit).

Clemens 27616, Dallas 3,000 feet, December 15th, 1931.

Distribution:—Sumatra, Java, Malay Peninsula,
Celebes, Sula Is., Philippines.

Cœlogyne venusta Rolfe in Gard. Chron. III, XXV (1904), 259.

Gardens Bulletin, S.S.

C. 3111, SFN 26530, Mahandui river c. 3,500 feet, March, 1933. Sepals and petals yellow or pale salmon pink. Lip white, a small yellow spot on each side at the base of the midlobe, a median yellow-brown line on middle of midlobe, keels white, 2 short outer keels on midlobe white with yellow base. Column white flushed with salmon pink especially on the back. Anther pale pinkish brown. Bracts pale pink.

Clemens 27002, Tenompok 5,000 feet, November 7th, 1931; 27418, Dallas 3,000 feet, December 5th, 1931; 27154, between Lumu Lumu and Kamborangah 7,000 feet, November 15th, 1931; 28417, Tenompok 5,000 feet, February 13th, 1932; 29407, Tenompok 5,000 feet, May 5th; s.n. Tenompok 5,000 feet, February 19th, 1932.

Distribution:—Endemic.

Cœlogyne longibulbosa A. & S. Orch. VI (1920), 33.

C. 2479, Mahandui river c. 3,600 feet, May, 1933. Bracts cream, brown-scurfy. Sepals pale yellow. Petals whitish. Lip blade white, side lobes yellow with white margins, midlobe white suffused pale yellow towards the apex, keels white the inner 2 double. Column white. Anther cream with brown margins.

Distribution:—Endemic.

Cœlogyne Moultonii J. J. S. in Bull. Jard. Bot. Buit. Ser. 2, III (1912), 2; l.c. II. Sup. t. 13, f. IV.

C. 3262, SFN 27112, Tenompok near the path to Ranau c. 4,800 feet, April, 1933. Bracts creamy yellow turning brown. Flowers hardly exsert. Sepals and petals white. Lip blade white, side lobes pale yellow with white margins, midlobe white with a large pale yellow spot at the base, 4 inner keels white tipped yellow, 2 short outer keels white, innermost 2 keels double on the blade between the side lobes. Column white. Anther cream with a brown median line, turning brown. Ovary and pedicel whitish, brown-hairy.

Clemens 29296, Tenompok 5,000 feet, April 16th, 1932.

This differs from typical plants in that the *middle* pair of keels, *not* the *median* pair do not reach to the base of the lip.

Distribution:—Endemic.

Cœlogyne radioferens A. & S. Orch. VI (1920), 38, t. 81.

C. 3121, SFN 27458, Marei Parei c. 5,000 feet, terrestrial, March, 1933. Sepals and petals deep ochre. Lip blade white with 4 brown lines, side lobes white veined brown with the apical margin chocolate-brown and a large brown blotch outside near the apex, midlobe chocolate-brown with white margins and base, keels white with the

apex on the midlobe brown speckled white. Column bright yellow-brown, suffused chocolate inside. Anther whitish with margins suffused brown. Bracts green. Ovary pale yellow, densely brown-hairy.

C. 3496, SFN 27458, Kamborangah c. 7,000 feet, terrestrial, June, 1933. Sepals and petals deep ochre-yellow. Lip blade white with 4 chocolate stripes, side lobes chocolate with white nerves and margins, midlobe chocolate with white margins and papillae and a broad transverse basal creamy white band. Common.

Distribution:—Endemic.

Cœlogyne hirtella J. J. S. in Bull. Jard. Bot. Buit. Ser. 3, XI (1931), 105.

C. 3122, SFN 26876, Penibukan ridge c. 4,500 feet, March, 1933. Flowers fragrant. Sepals and petals snow white with 2 brown lines, side lobes white veined brown with white margins, and a brown blotch with yellow margins near the apex outside, midlobe white with a large bright yellow blotch which is carried onto the apex of the blade, inner keels white but bright yellow below the dark brown apex, outer keels bright yellow tipped dark brown. Column white suffused brown in side. Anther cream. A very common plant.

Clemens 29478, Tenompok 5,000 feet, May 5th, 1932; 29638, Tenompok 5,000 feet, May 10th, 1932.

Distribution:—Endemic.

Cœlogyne (? § Elatæ) rupicola sp. nov. Pseudobulbi anguste ovoidei, bifolii. Folia lanceolata vel oblongolanceolata, acuta, plicata, rigida, basi petiolata. Inflorescentia foliis fere maturis synantha, erecta, apici pauciflora. Bracteæ oblongo-ellipticæ, obtusæ. Sepala extus breviter pilosa, carinata, oblongo-lanceolata, acuta. Petala oblanceolata, breviter apiculata. Labellum 3-lobum, lamina carinis 2 e basi ultra medium lobi intermedii abrupte terminantibus, carina brevi dimidio inferiore lobi intermedii addita, lobis lateralibus rotundatis obtusis, lobo intermedio breviter unguiculato lamina ovata triangulari-acuminata acuta.

Pseudobulbs up to c. 3 cm. distant, narrowly ovoid, grooved, base covered with the remains of tubular sheaths, up to c. 9.50 cm. long, 2-leaved. Leaves lanceolate or oblong-lanceolate, acute, plicate, rigid, 3-5 strong nerves beneath, 7-13 cm. long, 1-2.75 cm. wide, petiole grooved 2.30-6 cm. long. Inflorescence from between the nearly mature leaves, erect, stout, few-flowered, peduncle terete up to c. 28 cm. long c. .35 cm. diam. with 2-3 closely imbricating bract-like sheaths below the rachis, rachis flexuous c. 6.50 cm. long with internodes up to c. 1.60 cm. long. Bracts persistent,

oblong-elliptic, obtuse, margins involute about the pedicel and ovary, shortly appressed-hairy, c. 2.40 cm. long, c. 1.30 cm. wide, many-nerved. Sepals oblong-lanceolate, acute, keeled and shortly hairy outside the laterals strongly keeled, 7-9-nerved, white suffused pale salmon at the base, the median keel pale salmon, c. 2.70 cm. long, c. .90 cm. wide, the laterals subfalcate a little broader with a broader base. Petals oblanceolate, shortly apiculate, 3-nerved with the outer nerves much branched above the base, provided outside with a low grooved keel, white suffused pale salmon at the base, c. 2.77 cm. long, c. .85 cm. wide. Lip 3-lobed, grooved beneath for the whole length, provided on the blade between the side lobes with 2 minutely rugulose keels which rise from a basal tubercle, continue for c. .27 cm. as a thin raised nerve then abruptly thickened and double as far as the base of the midlobe and terminate abruptly above the middle of the midlobe, a short similar keel on each side in the lower half of the midlobe, blade and keels bright golden yellow, spread out c. 2.45 cm. long, c. 1.70 cm. wide, side lobes short broadly rounded white; midlobe shortly clawed with the margins of the claw minutely erose, blade ovate triangular-acuminate acute the radial nerves elevate near the minutely erose margins, white with golden yellow base, c. .80 cm. long and as broad. Column pale salmon with white wings and hood, c. 2 cm. tall, wings cuneately dilate from about the middle the apex rounded and sometimes provided with a minute tooth, hood transversely oblong with the upper margin minutely toothed, rostellum triangularovate obtuse incurved over and completely concealing the stigma, stigma quadrate with margins elevate especially the anterior which is recurved. Anther quadrangularly obovate, minutely retuse, a conic boss above, brown. Ovary 6-grooved, densely hairy, with the pedicel c. 2.65 cm. long, dark olive with dark brown hairs.

C. 3552, SFN 27793, Main spur above Kamborangah c. 9,000 feet, June, 1933.

Described from dried material and flowers preserved in spirit.

Cœlogyne papillosa Ridl. in Stapf in Trans. Linn. Soc. Bot. IV (1894), 238. etc.

C. 3522, SFN 27532, Main spur above Paka Paka c. 11,000 feet, June, 1933. Sepals and petals snow white. Lip blade yellow-brown, side lobes white with yellow-brown nerves, midlobe white with a large brown spot and white papillae, keels yellow-brown tipped white. Column white suffused pale salmon along the middle of the back and pale yellow-brown inside. Anther salmon pink.

Clemens 27172, below Paka Paka on rocks 10,000 feet, November 13th, 1931; 27862, above Paka Paka on granite crevices 12,000 feet, January 9th, 1932; 27872 Lumu Lumu 6,000 feet, January 14th, 1932; 29293, Masilau 7,000 feet, April 9th, 1932.

Distribution:—Endemic.

Cœlogyne exalata Ridl. in Journ. R. As. Soc. Str. Br. xlix (1908), 29.

Clemens s.n. Dallas 3,000 feet, January 1st, 1932.

Distribution:—Endemic.

Cœlogyne Clemensii A. & S. Orch. VI (1920), 23.

C. 3244, SFN 26988, Main spur above Tenompok c. 5,200 feet, April, 1933. Bract salmon-brown. Ovary and pedicle salmon-pink. Sepals pale yellow suffused pale salmon. Petals paler. Lip side lobes pale yellow suffused pale salmon towards the apex, midlobe pale yellow suffused pale salmon towards the margins and apex, blade and keels pale yellow. Column white. Anther cream with brown margins.

Kamborangah c. 7,200 feet, June, 1933. Flowers yellow-green or bright green. Column white.

Clemens 26952 Lumu Lumu on rocks 7,000 feet, November 12th, 1931; 27004, Tenompok 5,000 feet, November 7th 1931; 27167, (mixed with *Chelonistele amplissima* Carr) above Lumu Lumu on rocks 6,500 feet, November 15th, 1931; 27236, Dallas 3,000 feet, November 23rd, 1931; 28482, Tenompok 5,000 feet, February 19th, 1932.

Distribution:—Endemic.

var. angustifolia var. nov. A planta typica et foliis angustis et pedunculo longiore et floribus minoribus differt.

This variety is readily distinguishable by the very narrow leaves which are linear-oblanceolate, acuminate, conduplicate acute and measure 15-33.50 cm. long and .50-2 cm. wide with a grooved petiole up to c. 8 cm. long. Peduncle erect, slender, up to c. 13.50 cm .long, rachis up to c. 6-flowered 4 cm. long. Bracts 1.15 cm. long, .60 cm. wide. Dorsal sepal c. $1.25\times.52$ cm. Lateral sepals c. $1.37\times.52$ cm. Petals c. $1.17\times.37$ cm. Lip when spread out c. $1.30\times.75$ cm., claw c. .28 cm. long, midlobe, which has a sharp fold on each side below the apex, c. .47 \times .50 cm., the apex minutely apiculate. Column c. .80 cm. tall, hooded in the upper half with the hood rounded very shortly emarginate with an apical tooth.

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C. 3091, SFN 26453, Penibukan ridge c. 4,500 feet, July, 1933. Sepals and petals bright yellow-green or olivegreen, the sepals often, the petals sometimes, suffused dull red towards the apex or all dull red. Lip similar. Column pale green or pale reddish, hood white.

Cœlogyne plicatissima A. & S. Orch. VI (1920), 35.

C. 3516, SFN 27504, Kamborangah c. 7,200 feet, June, 1933. Sepals deep brownish salmon. Petals olive-green suffused pale brownish salmon towards the apex. Lip similar. Column pale yellowish, hood and wings white. Anther brown.

Below Paka Paka c. 9,500 feet, June, 1933. Sepals greenish yellow suffused salmon-pink from above the base to the apex. Petals and lip pale yellow-green suffused salmon-pink towards the apex. Column whitish.

Clemens 27185, above Lumu Lumu 7,000 feet, Novemebr, 15th, 1931; 29955, near Paka Paka on low jungle rocks 10,000 feet, May 31st, 1932; s.n. Kamborangah 8,000 feet, March 24th, 1932.

C. plicatissima A. & S. is a somewhat variable species both as to the dimensions of the flowers and as to the details of the lip. The Kamborangah plants resemble the type in the median nerve of the lip being dilate to a small triangular lamella below the apex but the flowers are much smaller. In the plants from the higher altitude, on the other hand, the flowers are a little larger than the type and the general outline of the lip is exactly typical but the median nerve is not dilate near the apex.

From what I have seen of the plants of this affinity they tend to show a rather wide range of variation. Thus *C. subintegra* J. J. S. appears to be the same as *C. exalata* Ridl. and it seems from the description quite possible that *C. rigidiformis* A. & S. is also synonymous.

These plants appear to constitute a special group characterized by the 1-leaved pseudobulbs, stiff heteranthous inflorescence with the rachis subtended by some closely imbricating bract-like sheaths, large persistent bracts involute over the base of the flower, rather fleshy flowers with the lip entire or indistinctly 3-lobed with the lower part tightly embracing the column, broad petals and the column which is abruptly dilate towards the apex into a broad rounded hood.

I propose a new section which may be called **Rigidiformes.** It will include *C. exalata* Ridl., *C. Clemensii* A. & S., *C. plicatissima* A. & S. and *C. albobrunnea* J. J. S. All these plants are endemic and no species has yet been found south of Sarawak.

Cœlogyne (§ Rigidiformes) craticulælabris sp. nov.

Caulis pendulus, elongatus. Pseudobulbi dissiti, ovoidei, 1-folii. Folium lanceolatum, obtusum. Inflorescentia brevis, nutans, laxe pauciflora. Bracteæ ovatæ, acutæ. Sepalum dorsale oblongo-lanceolatum, subacutum. Sepala lateralia lanceolata, subacuta. Petala obovata, subacuta. Labellum integrum, explanatum oblongo-oblanceolatum obtusum, dimidio inferiore carinis 3 humilibus medio fere carinula transversa sejunctis, dimidio superiore carinis 2 sub medio carina transversa sejunctis superne carina alta interposita. Gynostemium breve, ala apicali magna rotundata minute erosula.

Stem pendulous, stout, much branched, rooting at the base, up to c. 150 cm. long, c. .43 cm. diam., internodes up to c. 2.30 cm. long, covered at first with closely imbricating sheaths. Pseudobulbs on the primary stems up to c. 21 cm. distant, as close as 2.75 cm. on the branches, ovoid, more or less 4-sided, forming a very acute angle with the stem. 1.30-3 cm. long, 1-leaved. *Leaf* lanceolate, apex conduplicate obtuse, rigid, plicate, 7.50-17.50 cm. long, 1.10-3.10 cm. wide, petiole grooved .70-1.70 cm. long. Inflorescence from within the very young leaf, short, nodding, laxly fewflowered, peduncle nude c. 1 cm. long lengthening in fruit to c. 5 cm., with an apical bract-like involute sheath, rachis flexuous up to c. 6 cm. long, internodes up to c. .80 cm. Bracts persistent, large, involute and embracing the lower half of the flowers, broadly ovate, acute, c. 1.40 cm. long, c. 1.15 cm. wide. Flowers rather fleshy, hardly open, sepals and petals pale yellowish suffused salmon towards the fleshy apex. Dorsal sepal oblong-lanceolate, subacute, 5nerved, c. 1.05 cm. long, c. .40 cm. wide. Lateral sepals subfalcate, lanceolate, subacute, 5-nerved, c. 1.15 cm. long, c. .38 cm. broad. Petals subfalcate, obovate, subacute, 3-nerved with the outer nerves branched from the base, c. .95 cm. long, c. .45 cm. wide. Lip entire, shallowly ventricose, sides erect and closely embracing the column, when spread out oblong-oblanceolate, apex obtuse very fleshy, the sides incurved in a short sharp fold at c. 1/4 below the apex, provided inside in the lower 1/2 with 3 low simple keels joined about the middle by a transverse keel and in the upper 1/2 with 2 simple keels not reaching to the apex of the lip and joined below the middle by a transverse keel which gives rise to a tall median keel, c. 1.10 cm. long, c. .54 cm. wide. Column short, when spread out including the large hood obovate with the apex minutely erose c. .70 cm. tall, c. .57 cm. wide, rostellum ovate very shortly obtusely bilobed. Anther transversely elliptic, triangular obtusely bilobed, c. .15 cm. long, rugulose outside. Capsule ovoid, not winged, c. 2.70 cm. long.

This is a very distinct species of the section by reason of the pendulous habit though the characters of inflorescence and flowers leave no doubt that it belongs here.

C. 2665, SFN 27965, below Lumu Lumu c. 5,500 feet, August, 1933, Type.

Clemens 27759, Lumu Lumu to Kamborangah on logs and rocks 6,000-8,000 feet, January 7th, 1932; s.n. above Lumu Lumu 7,000 feet, January, 1932; s.n. Dallas 3,000 feet, January, 1st, 1932.

Described from dried material and flowers preserved in spirit.

CHELONISTELE Pfitz.

The discovery in Sarawak by the Oxford University expedition in 1932 and by myself on Mount Kinabalu in the following year of some very interesting species of *Chelonistele* renders it necessary to redescribe this genus on a rather different basis than that upon which it was originally proposed by Pfitzer in Engler's Pflanzenreich IV. 50. II. B. 7, 136.

Pfitzer included in his original account of the genus 2 species which obviously belong to the affinity of *Panisea* in which the bracts are persistent, namely *Ch. apiculata* (Lndl.) Pfitz. and *Ch. biflora* (Par. & Rchb. f.) Pfitz. These plants should be excluded.

Ch. crassifolia Carr, although a 2-leaved plant, has flowers entirely characteristic of Chelonistele proper, the floral structure resembling very closely Ch. sulphurea Pfitz.

In Notes Bot. Gard. Edin. xiii (1921), 188 Prof. Sir W. W. Smith described an interesting plant from Mount Kinabalu under the name *Chelonistele Keithiana* W. W. Sm. This plant, however, had already been made the type of a new genus, *Nabaluia*, by Prof. Oakes Ames in Orch. VI (1920), 70 under the name *Nabaluia Clemensii* Ames.

The three chief characters of *Nabaluia* were the bifoliate pseudobulbs, the deeply saccate claw of the lip and the 2 lamellae which take the place of the keels in *Chelonistele* and which are united transversely at the base thereby increasing the depth of the saccate claw.

The discovery, however, in Sarawak of *Ch. lamellulifera* Carr has convinced me that Prof. Sir W. W. Smith was correct in regarding *Nabaluia Clemensii* Ames as a *Chelonistele*. In *Ch. lamellulifera* Carr, which is 1-leaved and a true *Chelonistele* in habit, the claw of the lip is deeply saccate while the keels are represented by short lamellæ which are not, however, united at the base.

As well illustrated in the case of *Ch. crassifolia* Carr the character of 1- or 2-leaved pseudobulbs does not appear to be of more than specific value in this group of plants.

Chelonistele, with the exception of Ch. perakensis Ridl., Ch. pusilla Ridl. and Ch. sulphurea Pfitz., is entirely confined to Borneo. The following is a new description of the genus together with a key to those species known to me. I make no attempt for the present to divide the genus into sections preferring to await the result of further collecting especially in Borneo whence it is probable further interesting species will be brought to light. The plants are highly seasonal and the actual flowering periods are of short duration so that they are not very frequently encountered in flower.

Pseudobulbs 1-2-leaved. Inflorescence synanthous. Bracts caducous. Flowers simultaneous. Sepals subsimilar. Petals usually much narrower than the sepals, sometimes very narrow linear, often strongly revolute from the base. Lip 3-lobed, clawed, claw concave or saccate; keels 2 usually arising some distance above the base, short, sometimes represented by lamellæ; side lobes usually short and narrow arising above the claw; midlobe much larger, usually clawed, often with strongly dilate bilobed blade. Column conspicuously winged and hooded, the wings often abruptly dilate, stigma suborbicular excavate with conspicuously elevate margins. Pollinia 4 adhering to a viscid gland.

KEY TO THE SPECIES

Pseudobulbs 1-leaved.
Wings of column gradually dilate.
Leaf shortly abruptly acuminate or apiculate.
Keels of lip 4 lamellæ in 2 pairs superposed,
petals as broad as sepals 1. Ch. brevilamellata Carr n. comb. Keels of lip strongly triangularly dilate at apex, claw very long, petals broad ... 2. Ch. unguiculata Carr Keels of lip tapering from base to apex, petals narrow 3. Ch. cuneata Leaf obtuse or acute, not abruptly acuminate or apiculate. linear acute c. .50-.75 cm. wide. Flowers very small 4. Ch. ingloria Carr comb. Leaf oblong obtuse very thickly fleshy, base abruptly narrowed, petiole short ... 5. Ch. pusilla Ridl. Wings of column abruptly dilate above the base. Leaf obtuse or acute, not abruptly acuminate or apiculate.

Keels of lip reaching to apex of claw of midlobe 6. Ch. sulphurea Pfitz. Keels of lip reaching to above base of blade of midlobe. Leaf narrowly lanceolate acute. Column c. 1.17 cm. tall 7. Ch. kutaiensis Carr Leaf oblong-oblanceolate. Column c. .75 cm. tall 8. Ch. perakensis Ridl. Leaf shortly abruptly acuminate or apiculate.

Petals broad, ovate, acuminate. Colubroadest above base ... Column 9. Ch. lurida Pfitz.

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Petals narrow.

Claw of lip concave.

Column broadcast near the truncate toothed apex, midlobe c. 1.70

... 10. Ch. amplissima Carr n.

mmn broadest about the middle, midlobe c. .75 cm. wide 11. Ch. pinniloba Carr. n.

Claw of lip deeply saccate.

Keels 2 short lamellas between the
side lobes ... 12. Ch. lamellulifera Carr

Pseudobulbs 2-leaved. Wings of column gradually dilate, keels of lip simple 13. Ch. crassifolia Carr Wings of column abruptly dilate from about the

Claw of lip concave, keels short produced at base to a short lobe 14. Ch. Richardsii Carr Claw of lip saccate, keels 2 tall lamellæ united transversely at the base; side lobes tall, narrow 15. Ch. Clemensii Carr n.

Of the above the following are new combinations:

Ch. brevilamellata Carr (Coelogyne brevilamellata J.J.S.), Ch. cuneata Carr (C. cuneata J.J.S.), Ch. ingloria Carr (C. ingloria J.J.S.), Ch. amplissima Carr (C. amplissima A. & S.), Ch. pinniloba Carr (C. pinniloba J.J.S.) and Ch. Clemensii Carr (Nabaluia Clemensii Ames).

Chelonistele sulphurea Pfitz, in Engl. Pflanzenr. IV. 50. II. B. 7 (1907), 137.

C. 3343, SFN 27180, near Bundu Tuhan c. 4,000 feet, June, 1933; C. 3488, SFN 27443, near Bundu Tuhan c. 4,000 feet, June, 1933; C. 3580, SFN 27792, near Lumu Lumu c. 5,500 feet, July, 1933.

Clemens 29824, Tenompok 5,000 feet, June 7th, 1932; 29994, below Lumu Lumu 5,500 feet, June 8th, 1932.

Distribution:—Sumatra, Java, Borneo.

Chelonistele cuneata comb. nov. Coelogyne cuneata J. J. S. in Bull. Jard. Bot. Buit. Sér. 3, xi (1931), 97.

C. 3292, SFN 27028, below Lumu Lumu low down on tree trunks, common, c. 5,200 feet, October, 1933. Bracts pale salmon. Ovary pale salmon, pedicel pale greenish. Flowers yellow, an orange or yellow-brown spot at base of column and one on each side of the sinus of the apical lobules of the lip. The peduncle of the inflorescence elongates in fruit.

Distribution:—Endemic.

Chelonistele lurida Pfitz. in Engl. Pflanzenr. IV. 50. II. B. 7 (1907), 138. Coelogyne lurida L. Lind. & Cogn. in Lindenia xi (1895), 32; xii (1896), 33, t. 532: C. sarawakensis Schltr. in Notiz. Bot. Gart. Berl. viii (1921), 15.

C. 3518, SFN 27713, Kamborangah c. 7,200 feet, June, Sepals and petals greenish yellow suffused pale brown in the lower half, petals tipped whitish. Lip blade salmon; side lobes white a large chocolate spot beneath at

the sinus, base of anterior margin chocolate; midlobe claw salmon, blade white, a large yellow brown-edged spot at apex of claw and base of blade; keels salmon tipped yellow-brown. Column whitish with yellow-green keel and hood, speckled brown on the wings. Anther pale salmon.

Clemens s.n. above Lumu Lumu 7,500 feet, January 7th, 1932.

Coelogyne sarawakensis Schltr. (!) is only a state in which the leaves are much smaller than usual.

Distribution:—Endemic.

Chelonistele amplissima comb. nov. Coelogyne amplissima A. & S. Orch. VI (1920), 21.

C. 3755 below Kamborangah c. 7,000 feet, August, 1933. Sepals and petals cream. Lip with 2 yellow-brown spots at the base of the side lobes and one towards the apex of the claw of the midlobe.

Clemens 27181, above Lumu Lumu on rocks 7,000 feet, November 13th, 1931; 27167, (mixed with *Coelogyne Clemensii* A. & S.) above Lumu Lumu on rocks 6,500 feet, November 15th, 1931.

Distribution:—Endemic.

Chelonistele pinniloba comb. nov. Coelogyne pinniloba J. J. S. in Bull. Jard. Bot. Buit. Ser. 3, XI (1931), 98.

C. 3763, below Kamborangah c. 6,500 feet, May, 1933. Flowers cream suffused salmon, a brown spot on the lip. Distribution:—Endemic.

Chelonistele crassifolia sp. nov. Pseudobulbi approximati, anguste ovoidei vel cylindrici, bifolii. Folia oblongooblanceolata, obtusa, crasse carnosa, basi petiolata. Inflorescentia foliis juvenilibus synantha, brevis, c. 12-flora. Bracteæ caducæ, ovato-ellipticæ, acutæ. Flores eis sectionis Chelonistele similes. Sepala extus carinata, oblongo-ovata, obtusa lateralibus subfalcatis. lineari-lanceolata, obtusa. Petala Labellum longe unguiculatum, medio fere trilobum, carinis 2 e medio unguis usque ad medium lobi intermedii decurrentibus, lobis lateralibus falcatis triangularibus obtusis, lobo intermedio usque ad medium unguiculato lamina transverse elliptica breviter bilobula. Gynostemii alæ super basin sensim dilatatæ apici triangulares obtusæ, ala apicali rotundata minute erosa.

Pseudobulbs approximate, narrowly ovoid or cylindric, covered at first with imbricating sheaths, wrinkled when old, 3.50-8.50 cm. long, up to c. 1 cm. diam. near the base, 2-leaved. Leaves oblong-oblanceolate, obtuse, thickly fleshy,

up to c. 9 cm. long, c. 1.50 cm. wide, petiole grooved 1-3.30 cm. long. Inflorescence appearing from between the very young leaves, erect, c. 12-flowered, peduncle slender c. 4.50 cm. long, stout and lengthening in fruit to c. 10.50 cm., dilate upwards and a little flattened towards the apex, nude, rachis c. 7.75 cm. long with internodes up to c. .70 cm. long at the base and 1 cm. long at the apex. Bracts caducous, ovate-elliptic, acute, many-nerved, pale flesh, c. 1.80 cm long, c. .85 cm, wide. Dorsal sepal ovate-lanceolate, obtuse, apex and margins a little recurved, 5-nerved, keeled on the back, c. 1.40 cm. long, c. .55 cm. wide. Sepals and petals pale vellowish white. Lateral sepals oblong-ovate, obtuse, subfalcate, 5-nerved, keeled on the back, c. 1.40 cm. long, c. .53 cm. wide. *Petals* strongly reflexed above the middle, linear-lanceolate, obtuse, 1-nerved, c. 1.40 cm. long, c. .16 cm. wide. Lip long-clawed, 3-lobed from about the middle, provided inside with 2 thin entire keels which run from about the middle of the claw and terminate abruptly about the middle of the midlobe, pale yellowish white with a transverse semilunate vellow-brown spot at the base of the blade of the midlobe and a darker spot outside at the base of each side lobe, spread out c. 1.50 cm. long, c. 1.18 cm. wide across the side lobes; claw oblong, cuneately dilate towards the apex, 5-nerved, c. .55 cm. long, c. .35 cm. wide; side lobes falcate, triangular, obtuse, c. .33 cm. long, c. .25 cm. wide, minutely papillose towards the margins and apex; midlobe clawed to about the middle, in all c. .60 cm. long, c. .68 cm. wide, claw transversely oblong narrowed towards the apex c. .25 cm. long c. .55 cm. wide, blade transversely elliptic shortly obtusely bilobed minutely papillose towards the margins and apex with the margins subundulate and suberose c. .35 cm. long c. .68 cm. wide. Column keeled on the back as far as the base of the hood, pale greenish yellow, spread out c. 1.10 cm. long, c. .60 cm. wide near the apex of the wings, wings dilate gradually from above the base with the apex triangular blunt, hood broadly rounded minutely erose, rostellum rather large triangular acuminate obtuse keeled above, stigma semiorbicular with the anterior margin thin and conspicuously elevate but not recurved. Anther cap-shaped with a conic tubercle above which is produced towards the apex as a low keel, beak triangular obtuse, pale creamy brown, c. .15 cm. long, c. 18 cm. wide. Capsule trigonous with 3 tall thin keels, c. 3 cm. long.

C. 3565, SFN 28027, Main spur below Kamborangah c. 6,500 feet, taken alive to Singapore and flowering there in October, 1933. It is not uncommon along the main ridge from 5,500-8,000 feet.

Clemens 27152, above Lumu Lumu on rock 6,500 feet, November 15th, 1931; 27169, above Lumu Lumu on rock 7,000 feet, November 13th, 1931; 27365, Kamborangah on rocky ledge 8,000 feet, November 13th, 1931.

Described from dried plants and flowers preserved in spirits.

Chelonistele Clemensii comb. nov. Chelonistele Keithiana W. W. Sm. in Notes Bot. Gard. Edin. xiii (1921), 188! Nabaluia Clemensii Ames Orch. VI (1920), 71, t. 87.

C. 3474, Marei Parei c. 7,000 feet altitude, May, 1933. Sepals yellow suffused pale brown except on the margins and median nerve which is yellow-green. Petals yellow suffused pale brown on each side of the median line. Lip base and calli pure white; side lobes white outside, pale brown inside except on the margins; midlobe white with a large pale brown spot at the base, a large yellow-brown spot below the sinus of the apical lobules and a small yellow-brown spot below the apex of the lobules on each side. Column pale brown, hood brown. Anther cream with brown margins. Sometimes the sepals are not suffused brown and the column is often white with brown margins.

Clemens 27159, above and below Kamborangah on rocks 6,000-9,000 feet, November 13th, 1931; 27171, above Kamborangah on rocks 9,000 feet, November 15th, 1931; 27184, above Kamborangah November 15th, 1931.

Distribution:—Endemic.

Sigmatochilus kinabaluensis Rolfe in Gibbs in Journ. Linn. Soc. Bot. xlii (1914), 155, t. 3.

C. 3524, SFN 27533, Main spur between Kamborangah and Paka Paka, terrestrial on rocks under scattered dwarfed Leptospermum c. 9,500 feet, June, 1933. Young leaves reddish. Inflorescence and bracts red. Pedicel and ovary red or olive suffused red. Sepals and petals creamy white. Lip white. Column bright yellow-green.

Clemens 27153, above Paka Paka on rocks 11,500 feet, November 14th, 1931.

Distribution:—Endemic.

Pholidota pallida Lndl. in Bot. Reg. xxi (1835), sub t. 1777; Bot. Reg. xiv (1828), t. 1213 (as *Ph: imbricata*). C. 3012, Koung c. 1250 feet, August, 1933.

Clemens 26301, Dallas 3,000 feet, August 28th, 1931; 26773, Dallas 3,000 feet, September 28th, 1931; 27631, Dallas 3,000 feet, December 19th, 1931; s.n. Dallas 3,000 feet, September 24th, 1931; 26781, Dallas 3,000 feet, October 19th, 1931.

Distribution:—Sumatra, Java, Malay Peninsula, Siam, Burma, Celebes, New Guinea, Philippines, ? China, ? Australia.

Pholidota gibbosa De Vr. Ill. Orch. t. v, f. 1.

C. 3758, Tenompok c. 5,000 feet altitude, August, 1933.

Clemens 26835, Tenompok 5,000 feet, October 27th, 1931.

Distribution:—Sumatra, Java, Malay Peninsula.

Pholidota carnea Lndl. Gen. & Sp. Orch. (1830), 37.

C. 3336, SFN 28058, Upper Kinunut valley c. 4,000 feet, April, 1933.

Clemens 27398, Tenompok 5,000 feet, December 1st, 1931; 27239, Tenompok 5,000 feet, November 23rd, 1931.

Distribution:—Sumatra, Java, Malay Peninsula, Philippines.

Pholidota kinabaluensis Ames Orch. VI (1920), 68.

C. 3475, SFN 28059, Marei Parei c. 7,000 feet, May, 1933. Flowers snow white, lip sometimes green. Anther bright green. Bracts green, darker towards the apex. The petals are much broader than the sepals.

Distribution:—Endemic.

Pholidota Clemensii Ames Orch. VI (1920), 66.

C. 3563, SFN 27781, Main spur c. 6,000 feet, June, 1933. Flower white, anther brown. The sac of the lip is full of nectar.

Clemens 27805, about Paka and above in stunted jungle 11,000 feet, (?error), January 8th, 1932; s.n. Bundu Tuhan 4,000 feet, January 26th, 1932; s.n. Tenompok 5,000 feet, January 18th, 1932; 29992, falls above Lumu Lumu 7,000 feet, June 8th, 1932.

Distribution:—Endemic.

Pholidota ventricosa Rchb. f. in Bonpl. V (1857), 43. Clemens 26022, Koung 1,500 feet, August 3rd, 1931. Distribution:—Sumatra, Java, Philippines.

Dendrochilum conopseum Ridl. in Stapf in Trans. Linn. Soc. Bot. iv (1894), 236.

C. 3186, SFN 26759, Mahandui river c. 3,600 feet, March, 1933; C. 3412, SFN 27315, Koung c. 1,400 feet, May, 1933.

Clemens 26899 Dallas 3,000 feet, October 31st, 1931. Distribution:—Endemic.

Dendrochilum crassum Ridl. in Journ. Linn. Soc. Bot. xxxii (1896), 288.

C. 3172, SFN 26668, Menetendok gorge c. 3,000 feet, March, 1933.

Distribution:—Malay Peninsula.

Dendrochilum (§ Platyclinis) angustilobum sp. nov. Pseudobulbi approximati, anguste ovoidei, 1-folii. Folium ovatum ad oblongo-oblanceolatum, obtusum. Inflorescentia pendula, elongata, multiflora. Bracteæ ovatæ, acutæ. Sepalum dorsale oblongo-lanceolatum, acutum. Sepala lateralia ovato-lanceolata, acuta. Petala oblongo-lanceolata, acuta, marginibus minute erosulis. Labellum 3-lobum, basi anguste unguiculatum, in 2/3 partibus super basin carinis 2 papillosis donatum, lobis lateralibus anguste triangularibus acutis margine postico erosulo, lobo intermedio oblongo-oblanceolato breviter apiculato. Gynostemii alæ super basin ortæ quam ala apicalis subdentata breviores.

Rhizome short, branched. Pseudobulbs approximate, narrowly ovoid or fusiform, smooth, shiny grey-green more or less suffused red, up to c. 5 cm. long, 1-leaved. ovate to oblong-oblanceolate, obtuse, thin in texture, 3.50-10 cm. long, .90-2.75 cm. wide, petiole grooved up to c. .50 cm. long, green with narrow red margins or suffused red. Inflorescence from the apex of the nearly mature pseudobulb, pendulous up to more than 80-flowered, pale dull red, peduncle filiform but a little dilate upwards and furnished at the apex with a few empty appressed bract-like sheaths up to c. 5.50 cm. long, rachis up to c. 35 cm. long with internodes up to c. .40 cm. long. Bracts much exceeding the pedicel and ovary, ovate, acute, bright flesh colour, c. .25 cm. long. Flowers well expanded with sepals and petals a little incurved about the middle and recurved margins 3-nerved bright vellow-green with a darker keel outside. Dorsal sepal oblong-lanceolate, acute, c. .53 cm. long, c. .18 Lateral sepals ovate-lanceolate, acute, subfalcate, cm. wide. c. .50 cm. long, c. .20 cm. wide. Petals oblong-lanceolate, acute, margins minutely erose, subfalcate, c. .48 cm. long, c. .17 cm. wide. Lip stipitate to the column foot by a narrowly oblong claw, 3-lobed, blade pale olive provided with 2 papillose keels which are incurved and contiguous at the base and reach to about the middle of the midlobe, spread out c. .37 cm. long, c. .20 cm. wide across the apex of the side lobes, often provided with 1 or more minute teeth in the sinus of the lobes; side lobes pale greenish white, rounded and forming with the blade an ovate or

suborbicular hypochile, the free part narrowly triangular acute, posterior margin minutely erose; midlobe yellow-green with 2 converging brown streaks, oblong-oblanceolate or oblong above a cuneate base, rounded and shortly apiculate at the apex, margins very minutely erose towards the apex, c. .23 cm. long, c. .09 cm. wide. *Column* greenish tipped darker, hood ovate with the apex subdentate, c. .25 cm. tall, stelidia arising from above the base linear minutely papillose towards the apex reaching to about the middle of the hood.

This is allied to *D. longirachis* Ames from which it differs in the smaller pseudobulbs and leaves and in the rather larger flowers with an unusually narrow midlobe of the lip.

C. 3233, SFN 26874, Tenompok c. 5,000 feet, April, 1933, Type.

Clemens 29412, Tenompok, trail to Tomis 5,400 feet, May 2nd, 1932; 28949, Tenompok 5,000 feet, April 4th, 1932; 29295, Tenompok 5,000 feet, April 7th, 1932; 29361, Tenompok 5,000 feet, April 22nd, 1932.

Described from dried material and flowers preserved in spirit.

Dendrochilum (§ Platyclinis) lacteum sp. nov. bulbi approximati, anguste ovoidei, 1-folii. Folium vel elliptico-lanceolatum, acutum vel lanceolatum Inflorescentia multiflora. Bracteæ ovatæ, brevissime acuminatæ, acutæ. Sepalum dorsale lanceolatum, acutum. Sepala lateralia oblongo-lanceolata, Petala oblongo-lanceolata, acuta, marginibus minute erosulis. Labellum 3-lobum, inter lobos laterales carinis 2 papillosis donatum, nerva intermedia elevata, lateralibus triangularibus acutis margine postico irregulariter erose-denticulato, lobo intermedio obovato vel suborbiculari obtusissimo. Gynostemii alæ super basin ortæ lanceolatæ breviter acuminatæ subacutæ, ala apicali oblonga obtusa.

Rhizome short, branched. Pseudobulbs approximate, narrowly ovoid, up to c. 3.85 cm. long, 1-leaved. Leaf lanceolate or elliptic-lanceolate, acute or obtuse, thin in texture with 7-9 strong nerves, 2.33-12.50 cm. long, 1-2.90 cm. wide, petiole grooved up to c. 1.25 cm. long. Inflorescence from the apex of the nearly mature pseudobulb, manyflowered, peduncle erect filiform provided at the apex with a few appressed bract-like sheaths 3-11.50 cm. long, rachis nodding up to c. 17 cm. long internodes up to c. .50 cm. long. Bracts nearly twice as long as pedicel and ovary, ovate, very shortly acuminate, acute, furfuraceous with many elevate nerves outside, c. .45 cm. long, c. .37 cm. wide, pale

Sepals and petals 3-nerved, keeled on the back, semitransparently cream suffused pale salmon down the middle and at the base. Dorsal sepal lanceolate, acute, c. .70 cm, long, c. .23 cm. wide. Lateral sepals oblonglanceolate, acute, posterior margin nearly straight, anterior margin roundly dilate towards the base, c. .70 cm. long, c. Petals oblong-lanceolate, acute, base cm. wide. narrowed, margins minutely erose, c. .67 cm. long, c. .23 cm. wide. Lip stipitate to the column foot by a narrowly oblong claw, 3-lobed, cream, the midlobe darker in the middle, the base of the blade between the side lobes pale salmon, blade provided with 2 papillose pale salmon keels which are incurved and contiguous at the base and reach to above the base of the midlobe often produced as elevate nerves, median nerve elevate from base to apex, spread out c. .60 cm. long, c. .52 cm. across the side lobes; side lobes triangular, acute, papillose, posterior margin irregularly erose-denticulate; midlobe obovate or suborbicular, very obtuse, c. .34 cm. long and as broad. *Column* pale salmon, hood oblong obtuse pale yellow, c. .43 cm. tall, stelidia arising from above the base and reaching to the rostellum lanceolate shortly acuminate subacute pale salmon c. .20 cm. long.

This is another ally of *D. longirachis* Ames from which it is readily distinguished by the larger flowers and very different lip.

C. 3608, SFN 27892, above Lumu Lumu c. 6,000 feet July, 1933, type.

Described from dried plants and flowers preserved in spirit.

Dendrochilum kamborangense Ames Orch. VI (1920), 57, t. 84.

C. 3622, SFN 27908, Kamborangah c. 7,500 feet altitude, July. 1933. Sepals and petals yellow-green. Lip base yellow-green remainder brown often with paler or yellow or green margins and a pale yellow median line in the lower half. Column pale greenish yellow.

Clemens 27860, above Lumu 7,000 feet, January 13th, 1932; 27143, above Kamborangah on trees and rocks 9,000 feet, November 13th, 1931; 27146, below Paka Paka on rocks in shelter 8,500 feet, November 12th, 1931.

Distribution:—Endemic.

Dendrochilum crassifolium Ames Orch. VI (1920), 49, t. 84.

C. 3671, SFN 28047, above Tenompok c. 5,200 feet altitude, August, 1933. Sepals and petals pale yellow or yellow-green with a darker median nerve outside. Lip

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similar with the blade between the side lobes green and 2 pale yellow-brown streaks from the middle of the side lobes to about the middle of the midlobe. Column pale yellow, stelidia whitish.

Distribution:—Endemic.

Dendrochilum Dewindtianum W. W. Sm. in Notes Bot. Gard. Edin. viii (1915), 321; D. perspicabile Ames Orch. VI (1920), 62, t. 82, F. IV.

C. 3533, SFN 27562, Main spur above Lumu Lumu c. 6,500 feet, June, 1933. Sepals and petals yellow-green. Lip pale yellowish suffused bright green down the middle, keels bright green. Column pale green, stelidia whitish, hood white.

Clemens 27145, above Kamborangah 9,000 feet, November 15th, 1931; 27140, above Kamborangah 8,000 feet, November 15th, 1931; 27148, below Kamborangah 7,500 feet, November 12th, 1931.

Through the courtesy of the Regius Keeper, Royal Botanic Gardens, Edinburgh, who forwarded to Kew the type sheets of *D. Dewindtianum* W. W. Sm., I was enabled to make comparison with *D. perspicabile* Ames and found no specific differences.

The plant is a very common one on the main spur from 6,500 to 8,500 feet altitude. It is very variable in the leaf and flower dimensions and in the details of the lip.

Distribution:—Endemic.

Pseudobulbi angulatim ovoidei vel obpyriformes, 1-folii. Folium anguste lineari-lanceolatum, acutatum, acutum, rigidum. Inflorescentia folio maturo fere synantha, folium superans, multiflora. Bracteæ ovatæ, acutæ. Sepalum dorsale oblongo-lanceolatum, acutum. Sepala lateralia ovato-lanceolata, acuta. Petala latiora, e basi unguiculata elliptica, breviter acuminata, acuta. Labellum 3-lobum, intus dimidio inferiore carinis 2 basi conjunctis donatum, lobis lateralibus brevibus triangularibus obtusis margine postico minute erosulo, lobo intermedio late ovato acuto.

Rhizome creeping, branched. Pseudobulbs approximate to 1.25 cm. distant, forming an acute angle with the rhizome, angularly ovoid or obpyriform in the form of a buoy, minutely wrinkled, up to 1.25 cm. long, c. .85 cm. diam., 1-leaved. Leaf narrowly linear-lanceolate, abruptly acutate, acute, rigid, grooved above, keeled beneath, c. 7 cm. long, c. .43 cm. wide, petiole slender grooved up to c. 1.50 cm. long, Inflorescence appearing with the nearly mature leaf,

elongate, many-flowered, peduncle slender nude up to c. 5.50 cm. long, rachis up to c. 10 cm. long with internodes c. .27 cm. long. Bracts as long as or very little exceeding pedicel and ovary, ovate, acute, 3-nerved, c. .25 cm. long, c. .17 cm. wide. Flowers pale yellow with no markings on the lip, sepals and petals 3-nerved keeled on the back. Dorsal sepal oblong-lanceolate, acute, c. .50 cm. long, c. .15 cm. Lateral sepals ovate-lanceolate acute, subfalcate, c. .50 cm. long, c. .15 cm. wide. Petals elliptic above the shortly clawed base, shortly acuminate, acute, c. .43 cm. long, c. .17 cm. wide. Lip stipitate to the column foot by a short broad claw, 3-lobed, provided on the blade between the side lobes with 2 parallel keels which are incurved and confluent at the base and reach to above the base of the midlobe, spread out c. .35 cm. long, c. .20 cm, wide below the middle of the midlobe; side lobes short, triangular, obtuse, posterior margin minutely erose; midlobe broadly ovate from the cuneate base, acute, c. .24 cm. long. Column c. .20 cm. tall, hood oblong, truncate, subdentate, stelidia arising from each side of the stigma lanceolate obtuse as long as or a little longer than the hood, stigma oblong with elevate margins, rostellum ovate obtuse.

This plant is a near ally of *D. Dewindtianum* W. W. Sm. with which it agrees well in habit. It is, however, a smaller plant with narrower leaves and smaller differently coloured flowers.

C. 3623, SFN 27891, Tenompok c. 5,200 feet, July, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum angustipetalum Ames Orch. VI (1920), 47, t. 83.

C. 3684, SFN 28019, Marei Parei spur c. 6,500 feet, August, 1933. Sepals and petals pale yellow. Lip pale yellow with whitish margins, keels and elevate midnerve bright salmon pink. Column salmon pink, hood and stelidia whitish. Anther salmon.

Distribution:—Endemic.

Dendrochilum imbricatum Ames Orch. VI (1920), 54, t. 8, f. 1.

C. 3653, SFN 27998, Tenompok c. 5,000 feet, August, 1933. Pseudobulbs dark olive. Bracts brown with a dull pink tinge and paler apical margin. Sepals and petals pale yellow suffused pale salmon at the base and more or less suffused pale yellow-brown towards the apex. Lip blade pale yellow-green; side lobes pale yellow, apex yellow-brown, posterior margin brown; midlobe brown with pale yellow margins and median line.

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Distribution:—Endemic.

Dendrochilum (§ Platyclinis) acuiferum sp. nov. Pseudobulbi subapproximati, anguste ovoidei, 1-folii. anguste oblongo-lanceolatum vel oblongo-oblanceolatum. sub apice acuto angustatum. Inflorescentia folio bene evoluto fere synantha, gracilis, multiflora. Sepala lanceolata, acuta, Petala acutæ. elliptica vel lanceolata, acuta, marginibus dimidio superiore minute erosulis. Labellum 3-lobum. dimidio inferiore carinis 2 semiovatis basi carina transversa sejunctis donatum, lobis lateralibus brevibus rotundatis vel subtruncatis lobo intermedio late ovato vel transverse elliptico breviter acuminato acuto, marginibus minute erosulis.

Rhizome creeping, branched. Pseudobulbs subapproximate, forming an acute angle with the rhizome, narrowly ovoid, minutely wrinkled, up to c. 4 cm. long, 1-leaved. Leaf narrowly oblong-lanceolate or oblongoblanceolate, narrowed distinctly below the acute apex, up to c. 11 cm. long, c. 1.30 wide, petiole slender grooved up to c. 2.50 cm. long. Inflorescence from the apex of the young pseudobulb with the leaf nearly fully expanded, slender, longer than the leaf, laxly up to c. 17-flowered, peduncle filiform provided at the apex with an appressed bract-like sheath up to c. 14 cm. long, rachis stouter nodding up to c. 8 cm. long. Bracts nearly twice as long as the pedicel and ovary, broadly ovate, acute, keeled and furfuraceous outside, margins minutely erose, c. .37 cm. long, c. .33 cm. Sepals and petals keeled outside, 3-nerved, pale yellow or pale salmon. Sepals lanceolate, acute, the laterals subfalcate, c. .65 cm. long, c. .23 cm. wide Petals elliptic or lanceolate, acute, margins minutely erose in the upper 1/2, c. .57 cm. long, c. .20 cm. wide. *Lip* adnate to the column foot by a very short broad cuneate claw, 3-lobed, provided inside in the lower ½ with 2 semiovate keels which are joined by a transverse keel at the base, median nerve elevate, pale yellow suffused very pale salmon towards the apex and with a deep salmon basal spot, spread out c. .47 cm. long, c. .37 cm. wide across the midlobe; side lobes very short, rounded or subtruncate, margins minutely erose; midlobe ovate or transversely elliptic, shortly acuminate, acute, c. .35 cm. long, nerves inconspicuously elevate, margins minutely erose. Column c. .17 cm. tall, hood short triangular with a broadly rounded or subtruncate apex, stelidia basal very slender terete reaching to the rostellum, stigma ovate with anterior margin elevate.

This species is a close ally of *D. stachyodes* J.J.S. with which it agrees in habit; both plants are terrestrial and may

be found growing together. In *D. acuiferum*, however, the inflorescence is rather more lax and the colour of the flowers is rather different. But the main difference is to be found in the column. In *D. stachyodes* J.J.S. this is much shorter and the stelidia, where they are visible at all, occur only as very minute basal teeth.

C. 3550, SFN 27645, near Paka Paka c. 10,000 feet, terrestrial under dwarf *Leptospermum* or in the open, June, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum stachyodes J.J.S. in Rec. Trav. Bot. Neerl. 1 (1904), 77.

C. 3521, SFN 27531, near Paka Paka c. 10,000 feet, terrestrial under *Leptospermum* or in the open, June, 1933. Whole flower creamy white. Column salmon pink.

Clemens 27870, above Kamborangah 9,000 feet, January 8th, 1932; 29120, Kamborangah 8,000 feet, March 24th, 1932; 27141, above Paka Paka on sunny side of rocks on granite slope 11,000 feet, November 14th, 1931.

Distribution:—Endemic.

Dendrochilum grandiflorum J.J.S. in Rec. Trav. Bot. Neerl. 1 (1904), 66.

C. 3476, SFN 27430, Kamborangah c. 7,000 feet, June, 1933. Sepals and petals flesh. Lip deep flesh with darker keels. Column dark olive with pink base and stelidia, rostellum yellow. Anther cream suffused rose towards the crown.

Clemens 27866, between Kamborangah and Paka on rocks and trees 9,000 feet, January 8th, 1932; 27867, above Kamborangah 8,500 feet, January 8th, 1932: 29128, between Kamborangah and Paka 9,000 feet, March 24th, 1932; 27142, above Kamborangah on tree trunks 9,000 feet, November 13th, 1931; 27149, above Kamborangah on rocks and tree trunks 9,000 feet, November 12th, 1931.

Distribution:—Endemic.

Dendrochilum (§ Platyclinis) planiscapum sp. nov.

Pseudobulbi subapproximati, ovoidei, 1-folii. Folium lineare, acutum. Inflorescentia folio bene evoluto fere synantha, multiflora. Bracteæ subulatæ. Sepalum dorsale anguste oblongo-lanceolatum, acutum. Sepala lateralia anguste ovato-lanceolata, acuta. Petala oblongo-oblanceolata, acuta. Labellum valde inconspicue 3-lobum, inter lobos laterales carinis 2 donatum, lobis lateralibus vix rotundatis, lobo intermedio triangulari-ovato obtuso nervis inconspicue elevatis.

Rhizome stout, shortly creeping, branched. Pseudobulbs subapproximate, ovoid, wrinkled, up to c. 2.70 cm. long, c. 1.20 cm. diam., 1-leaved. Leaf linear, apex conduplicate acute, grooved above, keeled beneath, rigid, up to c. 30 cm. long, c. .85 cm. wide, petiole grooved up to c. 7 cm. long. Inflorescence from the apex of the pseudobulb with the leaf almost fully expanded, stout, many-flowered, peduncle nude strongly laterally flattened up to c. 16 cm. long provided at the apex with a bract-like sheath c. 1.50 cm. long. Bracts about twice as long as the pedicel and ovary, subulate, margins involute, lower ones longest up to c. 1 cm. long. Sepals 3-nerved, bright yellow-green or citron with a median green keel on the back, the laterals suffused red at the base. *Dorsal sepal* narrowly oblong-lanceolate, acute, c. .85 cm. long, c. .18 cm. wide. *Lateral sepals* narrowly ovate-lanceolate, acute, margins revolute, c. .68 cm. long, c. .18 cm. wide. *Petals* oblong-oblanceolate, acute, falcate, 3-nerved, margins strongly revolute, keeled outside, grooved inside, bright citron, c. .68 cm. long, c. .17 cm. wide. Lip strongly involute in the upper half, very inconspicuously 3-lobed, brown, provided inside to about the middle with 2 keels which are produced to near the apex as raised nerves, median nerve elevate on the midlobe, spread out c. .48 cm. long, c. .20 cm. wide, side lobes very inconspicuous scarcely rounded, midlobe Column pale yellow, narrowly triangular-ovate obtuse. hood and stelidia whitish the stelidia suffused pale salmon. in all c. .28 cm. tall, hood triangular apex truncate 2-3toothed, stelidia arising on each side of the stigma broadly lanceolate acuminate acute longer than the hood, rostellum ovate obtuse, stigma oblong with elevate brown margins. Anther vellow-green.

This is an ally of *D. simile* Bl., *D. odoratum* J. J. S., *D. lineare* Pfitz. etc. It is readily distinguished by the long very narrow leaf and the greatly flattened peduncle of the inflorescence.

C. 3663, SFN 28020, Tenompok c. 4,800 feet, August, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Platyclinis) graminoides sp. nov. Pseudobulbi approximati, ovoidei vel oblongo-ovoidei, 1-folii. Folium anguste lineare, oblique obtusum. Inflorescentia folio maturo synantha, gracillima, multiflora. Bracteæ ovatæ, acutæ. Sepalum dorsale ellipticolanceolatum, acutum. Sepala lateralia falcata, lanceolata, acuta. Petala falcata e basi angusta late lanceolata acuta, marginibus minute erosulis. Labellum

inconspicue 3-lobum, marginibus erosulis, inter lobos laterales carinis 2 brevibus basi carina transversa sejunctis donatum, lobis lateralibus vix rotundatis, lobo intermedio elliptico subacuto concavo.

Rhizome shortly creeping, branched. Pseudobulbs densely aggregate, ovoid or oblong-ovoid, minutely wrinkled. up to c. 1.10 cm. long, c. .45 cm. diam., 1-leaved. Leaf narrowly linear, grassy, apex obliquely obtuse, thin in texture, up to c. 13.50 cm. long, c. .20 cm. wide, petiole slender grooved up to c. 3 cm. long. Inflorescence from the apex of the pseudobulb with the leaf about fully expanded, very slender, many-flowered, peduncle filiform nude provided at the apex with some appressed closely imbricating bract-like sheaths up to c. 8 cm. long, rachis nodding flexuous a little thickened up to c. 6 cm. long, with internodes c. .23 cm. long. Bracts twice as long as the pedical and ovary, ovate, acute, c. .20 cm. long. Flowers yellow, sepals and petals 3-nerved. Dorsal sepal elliptic-lanceolate acute. c. .43 cm. long, c. .10 cm. wide. Lateral sepals falcate, lanceolate, acute, c. .40 cm. long, c. .10 cm. wide. Petals broadly lanceolate from the narrow base, acute, falcate, margins minutely erose, c. .37 cm. long, c. .12 cm. wide. Lip inconspicuously 3-lobed, margins minutely erose, 3-nerved, provided inside between the side lobes with 2 short keels which are joined at the base by a transverse keel, spread out c. .30 cm. long, c. .10 cm. wide, side lobes scarcely rounded, midlobe elliptic subacute concave. Column c. .15 cm. tall, hood cuneate with roundly triangular obtuse apex, stelidia arising from below the stigma short slender subulate reaching to the base of the hood c. .05 cm. long, rostellum large ovate obtuse, stigma ovate with elevate Capsule obovoid, crowned with the dried remains margins. of the flower, c. .45 cm. long, c. .27 cm. diam.

This is another plant of the same affinity as the preceding. It is readily distinguished by the narrow grassy leaves and very slender inflorescence.

C. 3680, SFN 28006, near Pinansak c. 3,000 feet, flowered at Singapore in November, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Platyclinis) Gibbsiæ Rolfe in Gibbs in Journ. Linn. Soc. Bot. xlii (1914), 147; D. kinabaluense Rolfe l. c. 148; D. quinquelobum Ames Orch. VI (1920), 63, t. 82, F. 2.

C. 3134, SFN 26745, Mahandui river c. 3,500 feet, March, 1933. Sepals and petals pale green. Lip lower half dark brown with a paler median line, side lobes and midlobe pale green. Column green, hood and stelidia white;

C. 3620, SFN 27884, near Bundu Tuhan c. 3,000 feet, July 1933. Flower green or yellow-green, lip with 2 brown spots about the middle. Anther cream; C. 3669, SFN 27970, Marei Parei c. 5,000 feet, August, 1933. Flowers transparently pale yellow, lip with a bright citron or yellow-brown spot in the sinus of the basal lobules. Stelidia whitish; C. 3709, SFN 28034, Kadamaian river c. 6,000 feet altitude, flowered in Singapore in October, 1933. Sepals and petals yellow. Lip yellow with 2 brown spots one at the base of each median lobe. Column yellow-green.

Clemens 26784, Dallas 3,000 feet, October 18th, 1931; s.n. Dallas 3,000 feet, October 12th 1931; 26841, Dallas 3,000 feet, October 28th, 1931; 26930, Dallas 3,000 feet, November 3rd, 1931; 29235, Tenompok 5,000 feet, April

14th, 1932.

Critical examination of the large collections made and careful dissections and drawings of the type material have compelled me to regard D. kinabaluense Rolfe and D. quinquelobum Ames as synonyms of D. Gibbsiae Rolfe. Careful drawings of Rolfe's species show nothing more than slight differences in the size of the flowers, the structure being identical. D. quinquelobum Ames differed from Rolfe's plants in the larger strongly recurved median lobes of the lip but the present collection includes every gradation from short straight lobes upwards.

There seems to be no question but that we have to deal with a plant which exhibits an amount of variation most unusual in the genus and this applies not only vegetatively but also to the dimensions and shape of the parts of the flower. Thus C. 3620 has consistently very much larger leaves than any of the examples hitherto seen by me yet the flowers are smaller even than those of *D. kinabaluense* Rolfe with broader sepals and petals and short broad straight median lobes of the lip. Moreover the small transverse keel within the large horse-shoe keel which occurs in the type plants of all the species is here lacking, as also in C. 3134.

Distribution:—Endemic.

Dendrochilum exasperatum Ames Orch. VI (1920), 50.

C. 3668, SFN 28029, Tenompok c. 5,200 feet, altitude, August, 1933. Flowers pale greenish yellow, lip with a triangular yellow-brown spot at the base of each median lobule, apical lobule a very long cusp; C. 3718, SFN 28049, near Tenompok c. 5,000 feet altitude, August, 1933. Sepals and petals cream. Lip cream with 2 brown spots.

Clemens 26784A, Dallas 3,000 feet, October 18th, 1931; 27256, Dallas 3,000 feet, November 20, 1931.

D' ('lation Endomina

Distribution:—Endemic.

Dendrochilum Haslamii Ames Orch. VI (1920), 53, t. 85.

C. 3528, SFN 27864, between Kamborangah and Paka Paka c. 9,500 feet, June, 1933. Sepals and petals pale creamy yellow. Lip blade brown, side and midlobes bright brown, apical cusp creamy yellow. Column olive-brown, stelidia pale brown tipped yellow-brown.

Clemens s.n. Kamborangah 8,000 feet, March 24th, 1932.

Distribution:—Endemic.

Dendrochilum corrugatum J. J. S. in Rec. Trav. Bot. Neerl. 1 (1904), 65.

C. 3675, SFN 28004, Kadamaian river c. 6,500 feet, August, 1933. Flowers pale yellow, base of lip greenish yellow.

Distribution:—Endemic.

Dendrochilum lancilabium Ames Orch, VI (1920), 58, t. 83.

C. 3752, Kamborangah c. 7,500 feet, terrestrial in moss and locally abundant, October, 1933. Flowers pale lemon.

Clemens s.n. above Lumu 7,000 feet, January 10th, 1932.

Distribution:—Endemic.

Dendrochilum fimbriatum Ames Orch. VI (1920), 51,

C. 3128, SFN 27428, Marei Parei c. 5,500 feet, March, 1933. Pseudobulb green suffused red or all red. Inflorescence red. Bracts red. Sepals and petals creamy white. Lip yellow-green. Column deep pink. Anther yellow.

Distribution:—Endemic.

This and the following six species form, together with *D. microscopicum* J. J. S., a well-marked group for which I propose a new section should be created. This could be called **Eurybrachion** and is characterized by the short stout column with very short rounded or inconspicuously lobed hood and comparatively large broad stelidia which are basal and about equal the column in length. The lip is entire and often broader than long and is provided with a conspicuous horse-shoe shaped keel. The face of the column is much dilate below the stigma which is thus conspicuously raised.

The following is a key to the species of the section which seems to be entirely confined to Borneo and *D. microscopicum* J. J. S., which is the only species known to occur

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outside British North Borneo. The species are all montane at altitudes of 5,000 to 11,500 feet:

Lip broader than long Margins fimbriate

.. 1. D. fimbriatum Ames

Margins entire

Blade subapiculate c. $.30 \times .44$

.. 2. D. transversum Carr

Blade shallowly retuse c. .18

 $\times .27$ cm. .. 3. D. scriptum Carr . .

Lip as long as or longer than broad

Blade ovate c. .64×.58 cm. . . 4. D. alpinum Carr

Blade ovate c. $.26-.35 \times .27-.30$

.. 5. D. pterogyne Carr

Blade oblong-obovate, shortly

apiculate c. .20×.15 cm. .. 6. D. alatum Ames

Blade oblong, base cuneate. apex long apiculate c. $.20\times$

.. 7. D. joclemensii Ames

Blade cuneate, bilobed, c. .05

cm. long and as broad .. 8. D. microscopicum J. J. S.

Dendrochilum (§ Eurybrachion) transversum sp. nov. Pseudobulbi approximati, anguste cylindrici, 1-folii. Folium lineari-lanceolatum vel lineari-oblanceolatum, breviter acutatum, cuspidatum. Inflorescentia synantha, multiflora. Bracteæ ovatæ. Sepala lanceolata, acuta, lateralibus falcatis. Petala oblongo-oblanceolata, acuta. Labellum integrum, transverse oblongum, subapiculatum. carina late hippocrepidiformi apicem haud attingente donatum.

Rhizome shortly creeping, branched. Pseudobulbs approximate, narrowly cylindric, minutely wrinkled, up to c. 4.50 cm. long, c. .65 cm. diam., green more or less suffused red or all red, 1-leaved. Leaf linear-lanceolate or linearoblanceolate, abruptly narrowed below the apex, apex shortly acutate cuspidate, rather thin in texture, keeled beneath, 9-23 cm. long, up to c. 1.20 cm. wide, petiole slender grooved up to c. 4 cm. long. Inflorescence from the apex of the pseudobulb with the young leaf not fully expanded, many-flowered, peduncle very slender nude with 2-3 appressed bract-like sheaths at the apex up to c. 20 cm. long, rachis up to c. 9 cm. long. Bracts ovate, as long as the pedicel and ovary, c. .28 cm. long. Sepals rose, broadly lanceolate, acute, 3-nerved, the laterals falcate, .47-.55 cm. long, c. .25 cm. wide. Petals oblong-oblanceolate, acute, 3-nerved, rose, c. .50 cm. long, c. .17 cm. wide. *Lip* entire, transversely oblong, subapiculate, margins recurved in the upper half, provided inside with a tall broadly horse-shoe shaped keel which encloses a concave area and which does not reach to the apex of the lip, spread out c. .30 cm. long, c. .44 cm. wide, deep ochre with darker apex and margins. *Column* pinkish brown, c. .17 cm. tall, hood very short a little dilate entire and transversely elliptic or with apex inconspicuously dilate and sub-3-lobed, stelidia basal as long and about as broad as the column oblong, acutate, obtuse, ochre tipped dark ochre-brown, rostellum ovate, obtuse, stigma excavate suborbicular with tall elevate margins.

C. 3477, SFN 27431, Marei Parei c. 7,000 feet, May, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Eurybrachion) scriptum sp. nov. Pseudobulbi c. 1 cm. dissiti, anguste ovoidei, 1-folii. Folium anguste lanceolatum, breviter acutatum, obtusum vel minute cuspidatum. Inflorescentia synantha, multiflora. Bracteæ ovatæ, quam ovarium longiores. Sepalum dorsale ellipticum, obtusum. Sepala lateralia ovata, obtusa, falcata. Petala oblonga, obtusa. Labellum integrum, transverse oblongum, leviter retusum, intus in 2/3 partibus inferioribus carina magna M-formiter sub apice pulvino humili donatum.

Rhizome shortly creeping, branched, densely covered with dry sheaths. Pseudobulbs c. 1 cm. distant, forming an acute angle with the rhizome, narrowly ovoid, minutely wrinkled, up to c. 2.50 cm. long, c. .65 cm. diam., red. 1-leaved. Leaf narrowly lanceolate, shortly acutate, obtuse or minutely cuspidate, rigid, keeled beneath, up to more than 13 cm. long, c. 1.10 cm. wide, petiole grooved up to c. 3 cm. long. Inflorescence from the apex of the pseudobulb with the leaf nearly mature, many-flowered, peduncle nude up to c. 6 cm. long, rachis c. 8.25 cm. long, with internodes c. .25 cm. long. Bracts much longer than the pedicel and ovary, ovate, c. .35 cm. long. Sepals ochre tipped brownish salmon with a salmon median line outside, 3-nerved, obtuse, the dorsal elliptic, the laterals falcate ovate, c. .30 cm. long, c. .20 cm. wide, laterals a little wider. Petals oblong, obtuse, 3-nerved, ochre, c. .30 cm. long, c. .17 cm. wide. Lip transversely oblong, shallowly retuse, provided inside in the lower 2/3 with a large M-shaped keel and below the apex with a low fleshy keeled cushion, reddish brown, keels paler, margins ochre, spread out c. .18 cm. long, c. .27 cm. Column dark reddish brown, c. .10 cm. tall, hood very short triangular obtuse, face much swollen below the stigma, stelidia basal as long as the column broadly elliptic.

C. 3597, Main spur above Kamborangah, c. 8,500 feet, July, 1933.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Eurybrachion) alpinum sp. nov. Pseudobulbi subapproximati, ovoidei, 1-folii. Folium anguste lanceolatum, apice conduplicato acuto. Inflorescentia synantha, multiflora. Bracteæ ovatæ. Sepalum dorsale oblongum, obtusum. Sepala lateralia ovato-oblonga, obtusa. Petala oblonga, obtusa. Labellum late ovatum, subacutum, intus per nervam intermediam elevatum, carinis 2 altis curvis paullo extrorsis basi incrassatione humili sejunctis.

Rhizome shortly creeping, branched. Pseudobulbs up to c. 1 cm. distant, ovoid, many-grooved, minutely wrinkled. up to c. 2.70 cm. long, c. 1 cm. diam., green, golden yellow or red, 1-leaved. Leaf narrowly lanceolate, narrowed above the middle, apex conduplicate acute, rigid, 7-13 cm. long, .80-1.50 cm. wide, petiole grooved up to c. 3 cm. long. *In*florescence from the apex of the young pseudobulb with the leaf nearly fully expanded, many-flowered, peduncle slender terete a lttle dilate upwards provided at the apex with 1-2 appressed imbricating bract-like sheaths up to c. 10 cm. long, with internodes c. .60 cm. long. Bracts much longer than the pedicel and ovary, ovate, acute, margins minutely erose towards the apex, densely furfuraceous outside with many elevate nerves, c. .50 cm. long. Sepals and petals 3-nerved, yellow suffused salmon or all salmon pink. Dorsal sepal oblong, obtuse, sometimes minutely apiculate, c. .78 cm. long, c. .44 cm. wide, Lateral sepals ovate-oblong, obtuse, sometimes minutely apiculate, keeled outside towards the apex, c. .78 cm. long, c. .40 cm. wide. Petals oblong, obtuse, c. .78 cm. long, c. .38 cm. wide. Lip entire, broadly ovate, subacute, rather incurved above the middle, elevate along the median nerve, provided in lower 3/4 with 2 tall curved suberect or rather extrorse keels which form with the median incrassation 2 grooves and which are joined at the base by a low cushion, salmon pink with brownish salmon median line, keels and apex, c. .64 cm. long, c. .58 cm. Column deep salmon pink, c. .20 cm. tall, the face much dilate below the transversely oblong stigma, hood very short dilate inconspicuously 3-lobed with the lobes triangular obtuse, stelidia basal as tall and nearly as broad as the column oblong-oblanceolate obtuse brown. Capsule obovoid with 3 rounded keels, c. 1.60 cm. long, c. .70 cm. diam.

This is the largest flowered species of the section.

C. 3545, SFN 27624, below Sayat Sayat c. 11,500 feet, June, 1933, growing on the sides of granite rocks and more or less sheltered by stunted trees.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Eurybrachion) pterogyne sp. nov. Pseudobulbi subapproximati, ovoidei, 1-folii. Folium lineari-lanceolatum, apice conduplicato acuto. Inflorescentia synantha, gracillima, c. 15-flora. Bracteæ ovatæ, acutæ. Sepalum dorsale ovato-ellipticum, breviter apiculatum. Sepala lateralia falcata, ovata, breviter apiculata. Petala elliptica, breviter apiculata. Labellum integrum ovale, minute apiculatum, carina magna hippocrepidiformi extrorsa saepe intus super basin carinis 2 connatis brevioribus additis, nervis elevatis.

Rhizome shortly creeping, much branched. Pseudobulbs approximate to 1 cm. distant, ovoid, minutely wrinkled, green or red, up to c. 2.20 cm. long, c. .75 cm. diam., 1-leaved. Leaf linear-lanceolate, apex conduplicate acute, rigid, 2.50-10.50 cm. long, c. .30-.80 cm. wide, petiole grooved up to c. 2.50 cm. long. Inflorescence from the apex of the young pseudobulb with the leaf nearly fully expanded, c. 10-15-flowered, peduncle filiform provided at the apex with 1-2 appressed bract-like sheaths up to c. 8 cm. long, rachis thickened flexuous forming an obtuse angle with the peduncle more or less quadrangular when dry up to c. 4.50 cm. long. Bracts longer than the pedicel and ovary, ovate, acute, furfuraceous outside with many raised nerves, c. .33 cm. long. Sepals and petals 3-nerved, shortly apiculate, concave, a little incurved above the middle, the lateral sepals keeled outside towards the apex, pale yellow tinted pale salmon or salmon pink with darker apex and median line. Dorsal sepal ovate-elliptic, c. .50 cm. long, c. .25 cm. wide. Lateral sepals falcate, ovate, c. .48 cm. long, c. .27 cm. wide. Petals elliptic, c. .47 cm. long, c. .25 cm. wide. Lip entire, oval, minutely apiculate, margins sometimes strongly recurved in the upper ½, provided in the lower ¾ with 2 tall curved extrorse keels which are incurved and united at the base to form a horse-shoe often produced inside above the base as 2 short adnate extrorse keels, nerves elevate from the apex of the keels almost to the apex of the lip, yellow with bright salmon pink base and keels or all salmon pink with base and keels darker, c. .26-.35 cm. long, c. .27-.30 cm. Column salmon pink, c. .20 cm. long, face strongly elevate below the stigma, hood very short a little dilate very inconspicuously 3-lobed, stelidia basal about as long and as broad as the column oblong-ovate obtuse. Capsule oblongobovoid, provided with 3 low keels, c. 1.10 cm. long.

C. 3541, SFN 27597, Paka Paka abundant on trees c. 10,200 feet, June, 1933; C. 3548, SFN 27635, Paka Paka c. 10,200 feet, June, 1933. Sepals and petals salmon pink. Lip

brown with salmon pink margins. Column deep salmon pink. Anther cream. Pseudobulbs red. This number differs from the type in that the lip is ovate and the leaves rather broader. After finding one specimen I was able to distinguish it from typical plants quite easily from the ground and at first considered that I had to do with 2 distinct species. For the present, however, I think it best included here.

Clemens 27864, Paka Paka 11,000 feet, January 8th, 1932.

Described from dried plants and flowers preserved in spirit.

Dendrochilum (§ Eurybrachion) alatum Ames Orch. VI (1920), 45, t. 82, f. 3.

C. 3715, below Kamborangah c. 6,500 feet, October, 1933. Pseudobulbs deep red. Leaf green often with reddish margins and reddish nerves beneath, petiole olive suffused dull red. Sepals and petals transparently pale yellow with a yellow-green median nerve. Lip pale yellow with bright citron nerves and keels, base and base of keels bright salmon. Column bright salmon pink, rostellum whitish, stelidia and hood whitish speckled red at the apex. Anther cream. Ovary and pedicel salmon.

Distribution:—Endemic.

Dendrochilum (§ Eurybrachion) **Joclemensii** Ames Orch. VI (1920), 55, t. 83.

C. 3710, Kadamaian river c. 6,500 feet, October, 1933. Flowers pale yellow, base of keel of lip pale salmon.

Distribution:—Endemic.

Claderia viridiflora Hook f. Fl. Brit. Ind. V (1890), 810; Ic. Pl. xxi (1892), t. 2083.

C. 3423, SFN 27339, Kokohitan hill c. 2,500 feet, May, 1933.

Distribution:—Sumatra, Malay Peninsula.

Dilochia Cantleyi Ridl. in Journ. Linn. Soc. xxxii (1896), 332.

C. 3129, Marei Parei c. 5,500 feet, August, 1933. Sepals creamy white. Petals white. Lip yellow-ochre speckled purple along the middle. Column pale greenish white.

Distribution:—Sumatra, Malay Peninsula.

Dilochia Wallichii Lndl. Gen. & Sp. Orch. (1830), 38.

C. 3422, SFN 27338, Kokohitan Hill c. 2,500 feet, May, 1933.

Clemens 27615, Dallas c. 3,000 feet, December 15th, 1931; 27728, Dallas c. 3,000 feet, December 31st, 1931.

Distribution:—Sumatra, Java, Malay Peninsula.

- Dilochia parviflora J. J. S. in Bull. Jard. Bot. Buit. Ser. 3, xi (1931), 112.
- C. 3246, Tenompok c. 5,000 feet, April, 1933. Sepals pale yellow suffused violet outside and at the base. Petals pale yellow with violet base. Lip blade pale yellow suffused pale violet at the apex, side lobes pale yellow, midlobe whitish suffused pale violet at the base, keels white. Column pale yellow suffused violet towards the base.

Distribution:—Endemic.

- Dilochia gracilis Carr in Gard. Bull. Str. Settle. 8 (1935), 91. Arundina gracilis A. & S. Orch. vi. (1920), 96.
- C. 3119, SFN 26550, Marei Parei c. 5,000 feet altitude, March, 1933. Sepals and petals cream suffused purple on the back except the margins. Lip creamy white, blade dotted purple, a large sulpur-yellow blotch at the base of the midlobe. Column white. Anther brown with a paler boss.

Clemens 29123, Kamborangah 8,000 feet terrestrial, March 24th, 1932; s. n. above Lumu Lumu 7,000 feet, January 10, 1932.

Locally abundant on ridge tops epiphytic but more commonly terrestrial, 5,000-7,500 feet.

Distribution:—Endemic.

Arundina speciosa Bl. Bijdr. (1825), 401.

C. 3174, SFN 26800, Menetendok/Kinataki divide c. 3,500 feet, March 22nd, 1933. Locally abundant on landslips, etc.

Distribution:—Sumatra, Java, Malay Peninsula, Celebes.

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PALMAE MALESICAE1

III.-Notes on some Malaysian Calami

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The results embodied in this paper were obtained mainly during a study undertaken by me in order to make myself familiar with the technique of describing and classifying the lepidocaryous palms of the Old World. A preliminary attempt to study these palms was made at the Botanic Gardens, Singapore, but as the Singapore herbarium does not possess representative specimens of some of the groups into which Beccari has divided the genera of these palms and also as very little material from the Singapore herbarium was seen by Beccari (2) a man to whom systematists owe more than to anybody else for bringing order into the classification of these palms which were previously in a maze of regular confusion—I was not able to make much headway in this my undertaking. I therefore made a second attempt, at the herbarium of the Botanic Gardens, Berlin, and as a result I have been able to prepare this paper. The success this time was due largely to the fact that I had a free access to the Berlin herbarium which possesses much authentic material carefully arranged by Prof. M. Burret, from all parts of the world where rattans grow. After completing the main part of my inquiry into these palms in Berlin, I was able to verify the accuracy of many of my conclusions and results in the herbaria of the Royal Botanic Gardens, Kew, and of the British Museum, London. My thanks are therefore due to the Keepers of all the three herbaria, and also to Prof. H. Harms and Prof. M. Burret of Berlin who were ever ready to help me with advice whenever I found myself in any difficulties.

Seventeen species of *Calamus* are discussed in this paper, of which the following 8 are new: C. orthostachyus, C. conjugatus, C. dachangensis, C. Kiahii, C. Kjellbergii, C. rostratus, C. stramineus with its var. megalospermus and C. tenompokensis. Of these new species, *C. orthostachyus* and *C. Kjellbergii* are from Celebes and the rest from Borneo *i.e. C. conjugatus* from Mt. Matang and the remaining five from the Kinabalu Mountain Range. This

Palmae Malesicae I in Fedde, Repertorium XXXV (1934)
 273-283; II in Gard. Bull. S. S. VIII (1935) 159-163.

^{2.} Much of the Singapore material was worked out by Ridley who had his own system of classifying the Lepidocaryae palms. This system is much less satisfactory than that of Beccari and it is unfortunate that Ridley did not adopt Beccari's system when preparing his Flora of the Malay Peninsula V published in 1925.

opportunity is also used to supplement the somewhat inadequate description of C. Burkillianus that has been published and to describe its male plant which was not known before. This species has also been recorded from another island, Pulau Kapas, lying to the north of the Tioman island (on the East coast of the Malay Peninsula), whence the species was originally described. Similarly the female plant of C. kandariensis (from Celebes), a species known only from a male plant, has been described. Reasons have been adduced to keep C. diffusus distinct from C. Oxleyanus and to reduce C. pauciflorus to C. filipendulus, C. distans to C. luridus and C. Hewittianus and C. Jaherianus to C. myriacanthus. C. longisetus was not recorded for the Malay Peninsula, though it was described from the Andamans and South Burma as far south as Tenasserim; but I have detected that this species has been collected twice in Langkawi island by Haniff and that it has been wrongly referred by Ridley to C. arborescens. The confusion that had crept over C. luridus and C. muricatus owing to the misidentification of specimens by Ridley has been cleared. Already Beccari had pointed out that the specimens of C. laxiflorus and C. scabridulus had been wrongly determined by Ridley as C. luridus [cf. Beccari in Ann. Roy. Bot. Gard. Calc. (quoted hereafter as Calcutta Annals or Calc.) Ann.) XI Suppl., 1913 pp. 13 and 33]. I have now found that some specimens identified by Ridley as C. luridus are really C. muricatus. As a result, the range of C. muricatus, which was regarded as endemic in Borneo is extended to the Malay Peninsula, while that of C. luridus which, on the authority of Ridley, was believed to occur also in Borneo (cf. Merrill, Enum. Born. Pl. 1921, p. 75) has become restricted to the Malay Peninsula only. C. polystachyus was hitherto considered to be native of Sumatra. The possibility of this record being wrong has been pointed out, while the species has been shown to occur as native in Sandakan, Its fruits are also described for the first time. Borneo.

It may perhaps be not out of place to draw the attention of botanists to some of the defects I have noticed in the recent collections and descriptions of the species of *Calamus* and *Daemonorops*. An inspection of some of the recent collections in the various herbaria I visited in Europe shows that the importance of the leaf-sheaths for the classification of these palms has not been understood by most of the recent collectors, though about three or four decades ago Beccari had written to demonstrate their importance and had later developed this thesis at length in his monographic studies published in the *Calcutta Annals* XI (1908) and XII (1911). There is many a species awaiting a critical study to clear its taxonomic status or position and though the

species has been re-collected in recent years, yet nothing further can be done because collectors have not made any attempts to secure better material to show its leaf-sheaths. Further it is important that collectors should record in the field-labels whether the leaves of a particular rattan terminate in a cirrus or not, noting at the same time its length when present; for from the leaf fragments that are usually preserved in herbaria it is not always possible to say whether a particular species bears a long or merely a short, abortive, cirrus to the leaves and this character very often affords a good clue in recognising the group to which a given rattan belongs. I have come across cases where, while the specimen from a principal set contains only the male organs, the specimens in the secondary sets distributed to other herbaria and purporting to be the exact duplicates of the former and therefore bearing the same field number, contain female spadices or spikelets and no male; or viceversa. Neither of the specimens give a clue to show whether or not these specimens were derived from one and the same plant. If both sorts of flowers are found on one and the same plant, it is desirable to include both kinds of flowers in one specimen. If different sexes are produced by different plants, then the specimens derived from the male plant should bear a different number from the ones taken from the female, and a note should be inserted in the field label to show whether both the sexes were represented in one group of plants growing together as if in a clone, or in different groups. It is therefore highly desirable for the institutions which send or support expeditions where rattans are indigenous, to give the collectors the necessary instructions on this matter so that the future collections may not suffer from the same defects as the ones made when these palms were very little understood and when botanists themselves did not know what parts were of diagnostic importance for these palms.

I have also noticed an unfortunate tendency to omit in the description of rattans to make any mention of the characters regarding the terminal leaflets (whether free or connate), the apex of the primary spathes (whether prolonged into a long, ear-like lobe and dilated in the upper parts, or tubular and truncate, or lacerate or not, etc.), spadix branches, spikelets and involucrophore (whether sessile or pedicelled), perianth (pedicelliform or not), etc. I call this tendency unfortunate because such characters are of great diagnostic value to distinguish most of the rattans and to find their affinities as has been amply demonstrated by Beccari (op. cit.). In the remarks made under C. luridus, I have pointed out the utter uselessness for practical

systematics to take into consideration the number of the transverse series of the scales on the *rattan* fruits. If the number is to be given, then it should refer to the longitudinal series.

A numerical list of the specimens cited in this paper is appended to show the species under which they are enumerated.

1. Calamus orthostachyus Furtado spec. nov.

Caudex scandens, circ. 8 m. longus. Frondis vagina spinis ad 0.8 cm. longis, basi dilatatis armatissima, infra petiolum gibbosa. Ochrea brevis ut videtur. Petiolus basi eomodo armatus, altera parte non visus. Frondes cirrhiferæ, secus rhacheos dorsum unguibus ad 5-fidis armatæ, parte pinnifera circ. 60 cm. longa. Cirrhus circ. 70 cm. longus, unguibus ad 5-7-fidis præditus. Segmenta plurrima, æguidistantia, glabra, 2.5-3 cm. inter se dissita, ad 25 cm. longa. 1.5 cm. lata, linearia, basi subito contracta, apicem versus sensim attenuata, acuminata vel fere filiformiter acuminata, apice in margine setosa, secus costam mediam setis ad 1 cm. longis utrinque prædita. Spadix foemineus erectus ut Spathae primariae (?) brevissimæ, cylindracæ, inermes. 1-2 cm. longæ, dorso elongatæ, acutæ. secundariae et tertiariae ad annulum brevissimum reductæ, dorso triangulariter productæ. Rami primarii (?) rigidi, ad 18 cm. longi, utrinsecus spiculas 8 gerentes, axi interjecta fere terete. Spiculae 4-8 cm. longæ, utrinsecus fructus 10-19 gerentes, fere patentes. Involucrophorum pedicelliforme vel subpedicelliforme. Involucrum leviter concavum. Perianthium fructiferum pedicelliforme, calyce corollæ acquilongo, apice trifido. Fructus ovato-oblongus, basi rotundatus, apice contractus, rostratus, cum rostro atro 0.2 cm. et perianthio 0.2 cm. longo omnino 1.3 cm. altus, 0.5 cm. Squamae stramineæ, secus marginem atropurpureæ, dorso canaliculatæ, in orthostichis 15 dispositæ. Semen nigrum, oblongum, 0.6 cm. longum, 0.3-0.4 cm. latum, 0.25-0.3 cm. crassum, rhaphen secus paulo elevatum, ceterum leviter rugosum vel non. Albumen album, homogeneum. Embryo basilaris. Spadix masculus juvenilis tantum visus, ut fæmineus.

CELEBES: on Bœlœ (=Mountain) Parema, alt. circ. 4,300 feet, in rain forest. (Kjellberg No. 2649. Type in the Berlin Herbarium).

The collector notes that the leaf-sheath is provided with thorns and the leaves have a long cirrhus.

In the specimen in Kjellberg's herbarium there is a terminal portion of a male spadix bearing the same number as the female specimen in Berlin. The collector does not state whether this male portion was obtained from the same plant as the female one. The male portion of the spadix is quite similar in structure to the female, and the species would therefore appear to fall in $Group\ XV^*$ of Beccari. But the erect spadix with its reduced spathes and with its somewhat pedicelliform involucrophorum distinguishes it at once from all the other species of Calamus known to me. In these respects it resembles very much some of the Calamus-like species of the genus Daemonorops, but the pedicelliform perianth with its calyx equal to corolla and the homogeneous albumen make one assign the species to the genus Calamus.

2. Calamus Burkillianus Becc. ex Ridl. Flor. Mal. Pen. V (1925), 56. Planta mascula.

Caudex scandens. Frondis vagina straminea, infra petiolum gibbosa, aculeis solitariis, applanatis, basi dilatatis, apice obscurioribus vel non, 0.8-1.5 cm. longis. Ochrea brevis, extus hispida, trichomatibus longis, rigidis, sinuosis, adpressis, deciduis, ferrugineis. Petiolus circ. 30-45 cm. longus ut videtur, stramineus, leviter furfuraceus, furfuro griseo vel brunnescenti, fugaceo, super applanatus vel concavus, ad 1 cm. latus, subtus convexus, aculeatus vel non, secus margines aculeis solitariis distantibus præditus. Rhachis subtus aculeis solitariis armata, non cirrhifera. Segmenta plurrima, equidistantia, alternantia vel sub-opposita, 2-5 cm. inter se dissita, lineari-lanceolata, 25-35 cm. longa, 1.5-1.8 cm. lata, in apicem ad margines spinulosam terminata, costis 3 percursa, costa media robustiore apicem versus subtus setosa, alteris supra eodemmodo armatis, subtus glabris, segmenta terminalia ambo basi Spadix masculus longe flagelliferus, unguiculatus, tenuis, duplo vel sub-triplo ramificatus. Spathae primariae tubulosæ, aculeolatæ, apicem versus fissæ, summo truncatæ; secundariae et Spathellae membranacæ, fusco-tomentosæ, truncatæ. Rami primarii nonnihil supra spatham orientes, 20-25 cm. longi, ramis secundariis utrinsecus ad 10, alternantibus; rami tertiarii abbreviatissimi 1 cm. usque longi, flores circ. 8 gerentes. Corolla 0.4 cm. longa, calyce duplo longior.

MALAY PENINSULA: Female specimens: Pulau Tioman off the Pahang Coast, Joara Bay (Burkill, s. n. in June, 1915. Type). Tringganu, Pulau Kapas (Holttum, 15211). male: Pulau Tioman, Ayer Batang (Henderson, 18465).

Material of this species was submitted to Beccari who had proposed the above name, but it was never published by him. Since the specific description given in the *Flora* was entirely drawn by Ridley, I think the species ought to be accredited to Ridley and may be quoted as above.

^{*} In Calcutta Annals XI, 1908.

I have described the male plant at some length in order to supplement the inadequate description of Ridley. It may also be added that the involucrophorum is not pedicelliform and that the fruiting perianth is explanate. The scales are arranged in 15-16 longitudinal series on the fruits, though Ridley gives only 10 as the number of rows (cf. my remarks on C. luridus re counting of these rows). The species belongs to the Group V Section B. 1 of Beccari in the Calcutta Annals and is perhaps allied to C. siamensis and and C. pseudotenuis. Judging from the plate 95 given by Beccari (Calc. Ann. XI, 1908, p. 266), this species could be easily confused with C. horrens Bl. a species described from a sterile specimen; but its ocrea is described as glabrous and the terminal leaflets free to the base. Recent fruiting and and flowering material from the type region seems to show that C. horrens is a form of C. tenuis, a species with a distinct pedicelliform perianth (Calc. Ann. XI Suppl. 1913. p. 39).

3. Calamus conjugatus Furtado spec. nov.

Caudex erectus (vel semi-scandens?), gracilis, 0.5-0.8 cm. (sine vagina 0.4-0.5 cm.) in diam. Frondis vagina fusca, infra petiolum leviter gibbosa vel non, apice oblique truncata, corrugationibus annularibus, interdum interruptis, transversis interdum obliquis, gracilibus, 1-2 mm. inter se remotis, secus marginem fimbriatis vel verruculosis. verruculis interdum pungentibus. Ochrea brevis, corrugata. Petiolus gracilis, 10-15 cm. longus, 0.2 cm. crassus, ima basi extus eodemmodo corrugatus, ceterus lævis vel spinulis aut verruculis sparsis, obscurissimis præditus, supra canaliculatus, apice in cirrhum abortivum 1-1.5 cm. longum, subtus aculeis robustiusculis, solitariis, deflexis armatum transiens. Segmenta gemina, opposita, patentissima elliptico-lanceolata, glabra, 5-6 costulata, apicem versus quam basin magis attenuata, ima basi abrupte contracta, plicatula, secus marginem apicum setulosa. Spadix foemineus circ. 35 cm. longus, ramis primariis 4, ad 6 cm. longis, sessilibus, utrinsecus spiculas 4, alternantes, ad 1.5 cm. longas gerentibus. Spathae primariae tubulosæ, apice oblique truncatæ, spinulis vel verruculis sparse armatæ, vel scabridæ. Spathllae et Involucrophorum sessile. involucra scabridæ. fructus et spadices masculi ignoti.

BORNEO: Matang (Ridley, in July, 1903. Type in Singapore).

From the characters observed this species falls in Beccari's *Group V*, *Sect. A* and appears to be a close ally of *C. zonatus* Becc. under which name the species was distributed by Ridley. It is however easily distinguished from the latter by its leaves which bear only one pair of

spreading, opposite, elliptic-lanceolate leaflets growing at right angles to the rachis, whereas in C. zonatus the leaves are divided into many, linear leaflets which are moreover porrect and not spreading. C. flabellatus Becc. placed by Beccari in Group V, Sect. B has also a pair of leaflets which are, however, porrect and connate at base, while it has a sheath which is guite unarmed and destitute of any transverse corrugations. C. digitatus which sometimes also produces unijugate leaves differs from the species here described by its leaflets being oblong-spathulate, abruptly contracted at the apex and connate at base, and by the presence of distinct spines and the absence of any transverse corrugations on the sheaths. *C. corrugatus* which in corrugations and the shape of leaflets approaches somewhat C. conjugatus is easily distinguished from the latter by its many-jugate leaves and by its short, hairy-furfuraceous petiole.

√4. Calamus dachangensis Furtado spec. nov.

Caudex scandens, circ. 3-7 m. longus, sine vagina 1.2-1.4 Frondis vagina flagellifera, infra petiolum gibbosa, oblique truncata, setis basi intumescentibus, tennuibus vel robustioribus dense obtecta, inter quas aculeis rigidis, ad 0.8 cm. longis, leviter reflexis, solitariis vel confluentibus prædita. Ochrea brevissima, extus ad marginem iisdem setis ut in vagina. Frondes cirrho carentes, cum petiolo circ. 45 cm. longæ, utrinsecus segmentis circ. 30. Petiolus 10-15 cm. longus, supra applanatus, aculeis sparsis brevibus, subtus convexus, aculeis in margine uti supra, in dorso majoribus armatus. Rhachis dorso aculeis solitariis vel trifidis sparsis prædita, utringue decidue ferrugineo-floccosa. Segmenta ad 30 cm. longa, 1.5 cm. lata, acquidistantia, 1-1.5 cm. inter se dissita, (apicalia breviora, libera vel basi paululo confluentia), subopposita vel alternantia, linearia, ad margines setulosa, e basi nonnibil plicata in apicem sensim attenuatum, acuminatum summo setis paucis præditum producta, subtus tomento floccoso ferrugineo deciduo obtecta, costis supra 3 distinctioribus, quarum media robustiore, longe-setosis (setis=1 cm. longis), subtus sat obscuris, media parce spinulosa. Spadix foemineus cum flagello apicali circ. 2 m. longus, duplo ramificatis, infra parce et breviter armatus, in parti terminali valide unguiculatus. Rami primarii 2-4, glabri, ad spatharum orificium orientes, 8-15 cm. longi, rami secundarii floriferi, sessiles, 5-6 cm. longi, floribus in seriebus duabus dispositis, secundis, utrinsecus 4-7. Spathae primariae: infima anceps, glabra, in marginibus aculeolata. oblique truncata; superiores teretiusculæ, inermes vel aculeatæ, glabræ, oblique truncatæ. Spathae secundariae et tertiariæ (=spathellæ) infundibuliformes, glabræ,

truncantæ. Involucrophorum distincte pedicilliforme: involucrum disciforme. Perianthium floriferum circ. 0.4 cm. longum, calyce corollæ æquilongo; fructiferum pedicelliforme, basi truncatum, apicem versus contractum, dein in lobulos dilatatum. Fructus elongato-ellipticus, utringue rotundatus apice abrupte mammillatus, cum mammilo 0.1 cm. et caudiculo 0.1-0.15 cm. longo, 1.6-1.8 cm. altus, circ. 1 cm. in diam. Squamae stramineæ, secus marginem fuscæ, in seriebus verticalibus 17-18 imbricatæ. Semen dense resinatum. lineari-oblongum vel oblongum. rotundatum, in latere foveali nonnihil applanatum, fove chalazali elongata, sulcis vel plicis irregularibus radiantibus ad embryonem in altero latere situm convergentibus, 1.2-1.4 cm. altum, 0.5-0.8 cm. latum, 0.4-0.6 cm. crassum. Albumen in parte exteriore fuscum, resina nigricans, leviter ruminatum vel sulcatum, sulcis resinosis. *Embryo* fere basilaris vel ad latus proxime basin situs.

Planta mascula ut fæminea, differt spadice graciliore,

calyce quam corolla 0.5 cm. longa duplo breviore.

BRITISH NORTH BORNEO: Mt. Kinabalu, on *Gunong Dachang*, alt. circ. 11,000 feet, (legit Furtado, comm. Clemens sub no. 29, 198, female. Type in Singapore), *ibid* (leg. Furtado, comm. Clemens sub num. 29, 198a male and female; may have been mixed during drying).

This belongs to *Group X* of Beccari and is very closely related to *C. exilis* Griff., from which, however, it differs in its leaf-sheaths being more thorny, in the absence of scabrid hairs or beard on the leaf-rachis, spathes and spadix-axis, in the perianth being somewhat contracted at the mouth of the tube and not distinctly campanulate, and the leaflets bearing thick ferrugineous tomentum beneath and long setæ in the upper surface of the 3 principal nerves. In *C. dachangensis* the leaflets appear also broader and the fruits more rounded at the apex and the base.

From C. Gibbsianus Becc. which resembles this species in many respects and which also belongs to the Group X, C. dachangensis is easily distinguished by its greater

number, closer and equidistant leaflets.

The stem is used to a certain extent by the Dusuns in wicker work, though they seldom visit the locality as it lies too far out of their way and also in the higher and therefore colder altitudes. Perhaps this *Calamus* has the same value as *C. Gibbsianus* or any of its allies growing at Kamborangah. The altitude of the Gunong Dachang may also be the same as that of Kamborangah. Dachang is not included in the maps I have consulted.

5. Calamus diffusus Becc. in Hk. f. Flor. Brit. Ind. VI (1892), 447; Ridley Mat. Flor. Mal. Pen. II (1907), 209; stat. nov.

√ C. Oxleyanus T. & B. sensu Ridl. Flor. Mal. Pen. V (1925), 62, quoad synonym C. diffusus, syn. nov.

This species was based on very imperfect material collected by Thomas Lobb in Singapore, consisting, as described originally by Beccari, of many equidistant, linearlanceolate leaflets with clawed, non-cirrhiferous (always?) rachis and strongly clawed [and therefore flagelliferous] male spadix. Probably because the spadix is somewhat similar to that of C. Oxleyanus and perhaps because the species has not been recorded again even in Singapore, the type locality, Beccari was later led to the conclusion that the spadix belonged to C. Oxleyanus, a conclusion recorded by him in the Calcutta Annals XI, 1908, p. 450, but he did not express any opinion regarding the leaf. In the Flora, Ridley relegates the entire species with spadix and leaves as a synonym of *C. Oxleyanus*, though he himself had remarked previously (*Materials*, *II*, 1907, p. 209) that *C. diffusus* is distinguished from *C. Oxleyanus* by its equidistant leaflets, while the latter has leaflets arranged in groups. After examining the type of C. diffusus in Kew, I came to the conclusion that it should be kept as distinct until one finds himself in a better position to determine its exact On my return to Singapore, I found that the material collected by Ridley under No. 11215 in the Batu Pahat district of Johore, and quoted by Ridley under C. Oxleyanus agrees very well with the description of C. diffusus, though the specimen is female. The leaf is young, is not provided with a cirrhus and has equidistant leaflets such as described for the species; and perhaps a further comparison may show that C. laxiflorus Becc. is also the same species. At any rate the conclusion seems to be clear that C. diffusus is not C. Oxleyanus, at least as far as the leaves are concerned.

6. Calamus filipendulus Becc. in Hook. f. Flor. Brit. Ind. VI (1892), 443; Rev. Bot. Curv. Ind. II (1902), 202; Calc. Ann. XI (1908), 188, pl. 45; Ridl. in Mat. Flor. Mal. Pen. II (1907), 193; Journ. F.M.S. Mus. IV (1909), 87; et Flor. Mal. Pen. V (1925), 51.

C. pauciflorus Ridl. Flor. Mal. Pen. V (1925), 56, syn.

Ridley's species is slightly less scabrid than some of the duplicates of the syntypes of *C. filipendulus* collected by Kunstler and preserved at Kew. In the *Key* given by Beccari in the *Calcutta Annals, C. filipendulus* should have been included in the *Section A of Group V*, among the species numbered 24-27 and not in the *Section B*, for the secondary spathes, spathels, etc., in this species are conspicuously scabrid. The *Key* given by Ridley in his *Flora* is rather difficult to follow and it is no wonder that Ridley

failed to recognise *C. filipendulus* in his *C. pauciflorus*. The following records should be added to those already given by Beccari.

MALAY PENINSULA: Pahang: Telom Ridge (Ridley, 13921). Perak: Jor near Tapah (Haniff 14252); Tapah, at Pahang Road, 10th mile (Burkill and Haniff, 13446, and 13451, Syntypes of C. pauciflorus).

7. Calamus kandariensis Becc. Planta fæminea.

Caudex scandens, circ. 5 m. longus. Frondis vagina inermis, longitudinaliter striata, infra petiolum gibbosa, apice oblique truncata. Petiolus 10 cm. circ. longus, supra convexo-applanatus, aculeis brevissimis, ad 0.2 cm. longis, dispersis præditus, subtus convexus secus margines aculeis 0.2-0.3. cm. longis, reflexis, solitariis armatus, utrinque dense griseo-tomentoso-furfuraceus. Rhachis sine cirrho circ. 52 cm. longa, in parte basilari in eodemmodo descripto vestita, subtus aculeis et unguibus armata, utrinsecus segmentis 7-8. Segmenta 3-4 costulata, secus costas paulo plicata, infima solitaria, alternata; reliqua ad 2 aggregata, opposita vel subopposita, 12-15 cm. inter se remota, lanceolata, circ. 25 cm. longa, 3-4 cm. lata, supra viridia, subtus glauca, apice contracta, acuta, subulata vel non, utringue inermia et basi decidue griseo-furfuracea. Cirrhus circ. 65 cm. longus, subtus unguiculatus. *Spadix foemineus* 0.75-1 m. longus, apice parte sterili 10 cm. longa, reflexo aculeolata terminatus. Spathae primariae: ad 15 cm. longæ, cylindrico-tubulosæ, striatæ, inermes vel dorso aculeolatæ, apice oblique truncatæ, basi contractæ, sensim in axin Spathae secundariae transeuntes. striatæ, inermes, glabræ, apice oblique truncatæ. Spathellae tubulosæ, striatæ, truncatæ, dorso in apicem triangularem productæ. Rami primarii nonnihil supra spatharum apicem orientes. Spiculae 2.5-4 cm. longæ, in ramis primariis alternantes, circ. 1.5-3 cm. inter se remotæ, nonnihil supra spathas insertæ, utrinsecus fructus 4-6 pedicelliforme; gerentes. Involucrophorum involucrum fructiferum pedicelliforme. disciforme. Perianthium Fructus immaturi tantum visi, oblongi, fere cylindrici, apice abrupte rostrati, cum rostro 0.2 cm. et perianthii tubulo 0.1 cm. longo 1.4 cm. altus, 0.5 cm. in diam. Squamae badiæ, unicoloratæ vel marginem secus paulo obscuriores, in orthostichis 13-15 dispositæ. Semen juvenile. Albumen paulo ruminatum ut videtur. *Embryo* basilaris.

CELEBES: Karebbe, by the Malike River, circ. 150 feet alt. (Kjellberg, 2398 in Kjellberg's herbarium in Sweden,

and in Berlin).

The collector's field notes state that this *Calamus* is a liane about 5 meters long growing along the river banks and that it is seldom found in flowers or fruits.

Though the plant here described bears larger, but fewer and more distant leaflets to the leaf which, moreover, become, on drying, greenish above and glaucous beneath (not brown as in the type), I think this plant is a female of *C. kandariensis* the type of which was also from the Celebes. Variations in the size of the leaflets and in their number on a leaf depend very largely on the age and vigour of the plant and sometimes even on the sex, while the colour depends on the habitat, vigor and the mode of drying. Unless therefore one gets a series of material of both the male and female plants, one cannot decide whether a certain plant is typical or represents a varietal form of a species. The spathes are somewhat inflated like those of the male spadix. There is no doubt that this species belongs to Group XII of Beccari as defined in the *Calcutta Annals*.

8. Calamus Kiahii Furtado spec. nov.

Caudex scandens, circ. 7 cm. longus, sine vagina 1-1.5 cm. in diam. Frondis vagina flagello carens, infra petiolum gibbosa, aculeis 1-1.5 cm. longis, robustis, horizontalibus, basi intumescentibus, dispersis, solitariis vel confluentibus armata, apice oblique truncata. Ochrea brevissima, apice in ligulam circ. 1 cm. longan reducta. Frondes cum petiolo cirrhoque 1.5-2 m. longæ, utrinsecus segmentis 7-9. Petiolus 5-12 cm. longus, supra ad basin leviter canaliculatus. Rhachis in parte pinnifera circ. 80 cm., in cirrhifera circ. 70 cm. longa, subtus aculeata; aculeis in parte basilari solitariis, in altera parte trifido-unguiformibus. plerumque bina, per greges 3-4 remotos alternantes vel suboppositos disposita, lanceolata, coriacea, concoloria, 5-7-costata, nervos sub-secundarios sat obscures secus plicata, glabra, media maxima, circ. 23 cm. longa, 2.2-2.7 cm. lata, maxima latitudine supra mediam partem sita, basi longe alternata, apice acuminata et ad margines spinulosa nervulis, transversis distinctiusculis. Spadix foemineus circ. 40-50 cm. longus, ramis primariis 3-5. Spathae primariae aculeis recurvis parce armatæ, infundibuliformes, oblique truncatæ, lepidibus piliformibus ferrugineis obtectæ, orificio ciliolatæ. Spathae secundariae et tertiariae similes, truncatæ, inermes, ferrugineo-lepidotæ. Rami primarii secundarii ad spatharum orificium orientes; secundarii flexuosi, circ. 5 cm. longi floribus 6-9 distantibus, distichis. Involucrophorum, sessile. Involucrum cupuliforme. Perianthium pedicelliforme, 0.3 cm. altum, corolla calvce æquilonga. Fructus ovoideus vel subglobosus cum rostello apicali 0.2-0.3 cm. et caudiculo basali 0.2-0.3 cm. longo, 2 cm. longus, circ. 1.2 cm. in diam. Squamulae stramineæ, seriebus 18 verticalibus imbricatæ, ad margines badiæ. Semen ambitu obovatum vel potius elongato-obovatum, basi attenuatum et acutum, apice rotundatum interdum obscure apiculatum, lateribus basin versus compressis, 1.4 cm. circ. longum, 1 cm. latum, 0.8 cm. crassum. *Rhaphe* elongata. *Albumen* profunde ruminatum. *Embryo* lateralis, modice infra dimidium latus, nonnihil supra basim situs.

British North Borneo: Mt. Kinabalu, at Lumu-Lumu, circ. 6,000 feet alt., (leg Furtado, comm. Clemens, sub. no. 29195. Type in Singapore).

This species belongs to Beccari's *Group XV B*. and is related to *C. caesius* Bl., from which it (*C. Kiahii*) can be easily distinguished by its much narrower, lanceolate (not oblanceolate), coriaceous, concolorous leaflets, by its straight (not reflexed) more closely placed spines on the sheath and by its lepidote spathes. The seed of *C. caesius* is described to be ovoid or to have a rounded base and subacute apex, but in *C. Kiahii* the seed is oblong or obovate with broad apex and often a narrowed base.

Named in honour of Kiah bin Haji Salleh, the plant collector of the Botanic Gardens, Singapore, who accompanied me on my trip to the Kinabalu Mountains in 1932.

/ 9. Calamus Kjellbergii Furtado spec. nov.

Caudex scandens, circ. 5 m. longus, sine vagina 1.5 cm. in diam. Frondes ut videtur longæ, cirrho circ. 1.20 m. Vagina spinis brevissimis vel indistinctis, distantibus armata, infra petiolum gibbosa, apice oblique truncata. Ochrea brevissima, inermis. Petiolus partim tantum visus infra convexus, dorso et margines secus eomodo armatus, supra concavus vel applanatus, spinis brevibus præditus. Rhachis dorso unguibus validis 3-4 fidis, apice fuscis et aculeis reflexis armata. Segmenta alternantia circ. 15 cm. remota, utrinque attenuata, basi angustata, apicem versus sensim vel subito acuminata et secus margines spinulosa, summo breviter bifida, utringue glabra, pluricostulata, secus costas sat plicata, 37.5 cm. longa, 5.5 cm. lata; costa media validiuscula, secundariis et tertiariis tenuioribus, fere æqui crassis. Spadix foemineus quam frondes brevior et non flagelliferus ut videtur. Spathae primariae tubulosæ, ancipites, dorso carinatæ, spinis brevissimis præditæ, circ. 12 cm. longæ, apice oblique truncatæ, in apicem acuminatissimam productæ; .secundariae tubulosæ, infundibuliformes, inermes, glabræ, basi ancipites, apice oblique truncatæ. Spathellae spathis secundariis consimiles, apice sæpe ciliolatæ. Rami primarii circ. 25 cm. longi, sessiles vel subsesiles, circ. 10 spiculis ferentes, in appendiculum 2 cm. longum, inerme exeuntes. Spiculae sessiles, (=ad spatharum orificium orientes), usque ad imam basin fructiferæ, 2-3.5 cm. longæ, utrinsecus fructibus 3-4. *Involucrophorum* sessile, apice cupuliforme. *Involucrum* late pateriforme, in involucrophoro fere inclusum. Perianthium fructiferum

explanatum, 0.8 cm. in diam., concavum, calyce corollæ æquilongo. Fructus depresso globosus, apice abrupte nonnihil rostratus, cum rostro 0.3 cm. longo 1.7 cm. altus, 1-1.1 cm. in diam. Squamae badiæ, secus marginem fuscæ, dimidiam secus canaliculatæ, in seriebus verticalibus 18 imbricatæ: Semen globosum, 0.7 cm. in diam, rhaphe haud impressa, sublæve, ceterum cerebriformiter alveolatum. Albumen ad ¼ diam. circ. ruminatum. Embryo basilaris.

CELEBES: Kawata, by the river Maliki, in rainforest, alt. circ. 650 feet (Kjellberg, No. 2367. Type in Berlin and with Kjellberg in Sweden). Ripe fruits are eaten by the local people.

This species belongs to the *Group XV-A* of Beccari and is very closely related to *C. arugda* Becc. from the Philippines, which however is described as having its leaflets bearing spiny margins and sometimes spinulous costæ above, its female flowers usually geminate in the lower part of the spikelet and the fruit scales in 15 longitudinal rows and not channelled along the middle. *C. Kjellbergii* on the other hand, exhibits no traces whatsoever of any geminate female flowers (only fruiting material was available for examination), has its fruiting scales arranged in 18 vertical rows and channelled along the middle, and bears leaflets which have spinules only along the margins of their apical portions.

10. Calamus longisetus Griff. in Calc. Journ. Nat. Hist. V (1844) 36, et Palms Brit. Ind. (1850) 44, t. 189 AB; Becc. in Calc. Ann. XI (1908) 134, pl. 9.

C. arborescens Griff. sensu Ridl. Journ. Roy. As. Soc. Str. Br. 59 (1911) 215, et Flor. Mal. Pen. V (1925) 64, quoad specimen lankawiense. syn. nov.

MALAY PENINSULA: Langkawi sine loc., (Haniff. in Sept., 1900 male). Gunong Raya (leg. Haniff, comm. Ridley sub. n. 15910 female).

This extends the distribution of this species which was hitherto recorded only for the Andamans and South Burma as far south as Tenasserim. It is easily distinguished from *C. arborescens* with which Ridley had confused it, by the disposition of the leaflets in definite groups at least in the lower portion of the leaf, by the absence of white or glaucous substance in the nether surface of the leaflets and by the presence of flagellum to the spadix.

V 11. Calamus luridus Becc. in Hk f. Flor. Brit. Ind. V (1892) 445; Ridl. Mat. Flor. Mal. Pen. II (1907) 198, pp. (ex altera parte=C. laxiflorus, C. muricatus and C. scabridulus), et Flor. Mal. Pen. V (1925) 56, pp. C. distans Ridl. Flor. Mal. Pen. V (1925) 56, syn. nov.

I have compared the types of Ridley's species with the duplicates of the syntypes of *C. luridus* preserved at Kew and find no material difference to give an independent status to Ridley's species.

Contrary to the usual practice, Ridley has the habit of stating, in his descriptions of Calami, the number of the transverse rows of scales on the fruits and in doing so he mentions the number of only those rows which appear to him very important. Hence he arrives at 5 as the number of rows in the fruits of C. distans, though so low a figure has not yet been noted in any Calamus fruits. method of counting rows of the fruit scales is very misleading as there is no sure criterion by which the scales could be divided into two classes of major and minor importance; and, if one were to attempt to count all the transverse series of scales, much useful time would be wasted since the number thus obtained will be dependent on the development of the fruits and also of the apex, and even if fully developed fruits were available in every case, the method will not be serviceable for practical systematics as the minuteness of many of the scales will discourage botanists from making use of this character in systematic accounts. Hence it is desirable that only longitudinal series of rows should be mentioned in descriptions and these are not only easy to count and independent of the size of the fruits but they are also most useful in identification of rattans. The scales in the type of C. distans are arranged in 15-16 longitudinal series. The following specimens in the Singapore herbarium belong to this species.

MALAY PENINSULA: Johore, Gunong Berhidong, alt. 1,000 feet (Holttum 10974); Sungei Tebrau (Ridley, 9207). Pahang, Fraser Hill, alt. circ. 4,000 feet. (Burkill and Holttum, 8807); Sungei Yet on Fraser Hill, alt. 3,700 feet (Nur. 11,130). Negri Sembilan, Bukit Senaling at Kuala Pilah (Moorhouse, ver. name Rotan Kerai and Rotan Perut Ayam). Perak, Kinta Valley (Ridley, 9814); Taiping Hills (Ridley, 11,987). Kelantan, Gunong Sitong, alt. 900 feet (Nur with Foxworthy, 12,188, Type of C. distans).

The vernacular name Rotan Perut Ayam apparently belongs to the species C. muricatus, for it appears that, instead of writing the name on a different sheet Ridley put it through an error on the sheet on which the spadix of the Rotan Kerai was mounted. Both these specimens were sent by Moorhouse from Kuala Pilah.

As far as is known this species has not been recorded from Borneo. Ridley's statement (repeated by Merrill in Enum. Bornean Pl., 1921. p. 75) that this species occurs in

Borneo is probably based on misidentification of the specimens of *C. muricatus*; in fact I have found some of the specimens of *C. luridus* put by Ridley in the cover of the former.

- ✓ 12. Calamus muricatus Becc. Nelle For. di Borneo. (1902) 609; Calc. Ann. XI (1908) 172 & pl. 33, & Suppl. (1913) 9.
 - ✓ C. luridus Becc. sensu Ridl. Mat. Flor. Mal. Pen. II (1907) 198 et Flor. Mal. Pen. V (1925) 56 p.p. syn. nov.

MALAY PENINSULA: Selangor, Rawang (Ridley, 12118). Negri Sembilan, Bukit Senaling at Kuala Pilah (Moorhouse).

This species was hitherto regarded as endemic in Borneo.

The vernacular name Rotan Perut Ayam, quoted by Ridley under C. luridus apparently belongs to this species. Moorhouse had sent two Rotans from Bukit Senaling, one known as Rotan Kerai and the other Rotan Perut Ayam. Obviously through an error the label bearing the latter name found its place on the sheet on which the spadix of Rotan Kerai (C. luridus) was mounted.

- v 13. Calamus myriacanthus Becc. in Rec. Bot. Surv. II (1902) 214; Calc. Ann. XI (1908) 251, pl. 85, et. Suppl. (1913) 38. (Type from Mount Matang, Borneo).
 - C. Hewittianus Becc. in Calc. Ann. XI Suppl. (1913) 45 pl. 24 (Type from Mt. Matang). Syn. nov.
 - C. Jaherianus Becc. in Calc. Ann. XI Suppl. (1913) 46 pl. 25 (Type from Dutch Borneo). Syn. nov.

I have had an opportunity of examining some authentic material named by Beccari himself and preserved at Kew, and as a result I come to the conclusion that the above three species are identical. The young flowers have a strongly striated calyx as is seen even in the specimen collected at Sioul by Hewitt in 1905, sub. n. 29 and identified by Beccari as the male of C. myriacanthus in the Calcutta Annals Suppl. l.c., as well as in another specimen also collected at Sioul by Hewitt in 1906 (or 1900?), sub. n. J.; but, as the flowers develop, these striations tend to disappear or remain only in the lowermost portion of the calyx. The young spadices of *C. myriacanthus* would therefore be *C.* Jaherianus which is described from a male spadix only (with no leaves and sheaths), though from the other characters given the latter is scarcely separable from the former. In the type of C. Hewittianus the leaves are juvenile and tend to be glaucescent as in the above named Sioul specimens, but it is hardly distinguishable from C.

myriacanthus. The leaf-sheath with a portion of stem is not represented in the type, though it is described and photographed by Beccari. As there are not even marks to show that it was mounted on the sheet I conclude that the portion was inadvertently placed on the sheet when the latter was being photographed and so Beccari may have been misled to make of the specimen thus constituted a new species quite distinct from C. myriacanthus.

14. Calamus polystachyus Becc. Calc. Ann. XI (1908) 383 et in Suppl. (1914) 77.

Beccari had described this species from the specimens gathered from a plant of uncertain origin, cultivated in the Buitenzorg Botanic Garden. Later he found in the Buitenzorg Herbarium a specimen that had a ticket which probably did not belong to the specimen, since, according to Beccari, it is unthinkable that Teysmann would name the specimen, even provisionally, as *Calamus rhomboideus* Bl., a name apparently entered up on the ticket by Teysmann himself. This being the case I do not understand why Beccari regarded the specimen as coming from Sumatra. In the absence of other signs or evidences to show that the specimen was collected in Sumatra, it is better, in my opinion, not to go by the locality given on a wrong label and, therefore, to disregard altogether the record of the species for Sumatra.

The species is, however, known to be wild in Borneo in the vicinity of Sandakan, where Ramos found it twice in 1920 (cf. Ramos nos. 1400 and 1788 distributed from Manila without any specific name). Ramos specimens bear fruits which, to complete Beccari's description, are here described:—

Perianthium fructiferum explanatum, profunde partitum. Fructus globoso-ovatus vel ovatus, 1.5 cm. (cum rostello 0.1 cm. longo) altus, 0.7-1 cm. in diam. Squamae in orthostichis 12 dispositæ, stramineæ, in margine atratus vel non, dorsum secus canaliculatæ. Semen ambitu orbiculare vel ovoideum, 1 cm. longum, 0.8 cm. latum, 0.5 cm. crassum, fovea chalazali late concava, ceterum leviter sulcatum vel rugosum, extus albido-fibroso-tomentosum. Albumen albidum, homogeneum. Embryo basilaris.

British North Borneo: near Sandakan (Ramos. nos. 1400 et 1788).

This species is at once distinguished from all the others by the presence of two or three distinct spikelets at each secondary spathe in the lower part of the partial inflorescences. This and *C. aquatilis* Ridl. are the only species known to me to have a fibrous tomentose integument on the seeds. Beccari opines that this tomentose surface on the seeds is due to the cellules of the integument persisting after the destruction of its fleshy part in drying. Like *C. aquatilis*, this species has leaflets which are finely spinulose along the costæ beneath, in which surface also it is provided with minute rusty scales. Were it not for the presence of more than one distinct spikelet in the axils of many secondary spathes it would not have been easy to separate this species from *C. aquatilis* Ridl. which also belongs to the same group (*Group XIV* of Beccari) though found only in the Malay Peninsula.

√ 15. Calamus rostratus Furtado spec. nov.

Caudex scandens, ad 4 m. longus, cum vagina 2.5 cm. in diam. Frondis vagina flagellifera, oblique truncata, infra petiolum conspicue gibbosa vel geniculata, aculeis approximatis, valde applanatis, elasticis, patentibus, plus minus in seriebus obliquis vel transversalibus dispositis, ad 5 cm. longis, basi 0.6 cm. latis horride armata. Ochrea liguliformis, ligulis deciduis, ad basin aculeis ut in vagina, ad 15 cm. longis et 0.6 cm. latis, porrectis prædita. cirrho carentes, cum petiolo 1.50-1.75 m. longæ, utrinsecus segmentis 48-53, circ. 2 cm. inter se remotis. Petiolus 7-20 cm. longus, flavescens, supra concavus, subtus convexus, secus margines ambo aculeis regidis, solitariis, rarissime confluentibus, 0.4-3 cm. longis ad 0.4 cm. latis, in duabus seriebus obscuris dispositis, subtus dimidium petiolum secus aculeis solitariis, brevioribus, remotis armatus. Rhachis flavescens, subtus aculeis solitariis remote armata. æguidistantia, alternantia vel Segmenta subopposita. rarissime opposita, linearia, basi paulo cuneata, apicem sensim attenuatam, acuminatam, ad margines spinulosam terminata, supra costis 3, quarum media robustiora, glabra, alteris subprimariis spinulosis percursa, subtus costas secus spinulis quam facie superiore magis approximatis, minoribus armata, basilaria angustissima, media longissima circ. 30-35 cm. longa, 1.5-1.8 cm. lata, apicalia brevissima basi ad 1/6 connata. Spadix foemineus cum flagello apicali circ. 4 m. longus, duplo- vel subtriplo -ramificatus, unguibus 4-furcatis armatus. Rami primarii sæpissime 4, remoti, longe-pedunculati, pedunculo ad maximam partem spatha incluso; ramis secundariis circ. 15, sessilibus, ad spatharum orificium insertis, floriferis, 10-15 cm. longis, circ. 5-7 cm. inter se dissitis, rarissime ramificatis, ramis tertiariis 3-5 cm, longis. Spathae primariæ tubulosæ, aculeolatæ, apicem versus sæpe fissæ, apice oblique truncatæ; secundariæ tubulosæ, oblique truncatæ, inermes vel aculeis rudimentari-Spathellae truncatæ, glabræ. Involucrophorum sessile; involucrum cupuliforme. Perianthium distincte pedicelliforme, apicem versus contractum, demum dilatatum et lobulatum; calyx corollæ æquilongus. Fructus nondum

plane maturus, ellipticus, cum rostro 0.2-0.3 cm. longo et caudiculo 0.1-0.15 cm. longo, 1.5-1.8 cm. altus, circ. 0.8 cm. in diam., utrinque contractus. Squamae in vivo flavidae, in sicco badiæ, concolores (margine haud diversæ), in seriebus verticalibus 15-17 dispositæ. Semen ambitu ovoideo-ellipticum, utrinque rotundatum, 0.8-0.9 cm. longum, 0.6 cm. latum, 0.4-0.5 cm. crassum, fovea chalazali in dimidio latere impressum, in altero latere dense rugulosum. Albumen profunde ruminatum. Embryo basilaris.

Planta mascula ut fœminea, sed spiculis brevioribus, floribus magis approximatis, calyce quam corolla 0.4 cm. longa duplo minore, perianthio infra apicem non contracto differt.

British North Borneo: Kinabalu Mts. at *Tenompok*, alt. circ. 4,500 feet, female, abundant (legit Furtado, comm. Clemens sub. no. 28650. Type in Singapore); *ibid*, male plant (leg. Furtado, comm. Clemens sub no. 28844); *ibid*, alt. 5,000 feet Clemens, n. 28566 (bis) female spadix only, leaves of a different plant); *ibid* (Clemens no. 28375, female).

This species belongs to Group IX of Beccari and in certain respects approaches very near to C. diepenhorstii and C. marginatus Mart. From C. Diepenhorstii, C. rostratus differs by its longer spines on sheath and ochrea, the leaflets being more approximate, the terminal pair of the leaflets being somewhat united at base (and not free). perianth more pedicelliform, fruit scales being not (or obscurely) bicolorous and the seed not globular. From C. marginatus it differs in the longer spines on the sheath and ochrea, larger and rostrate fruits, reddish brown, concolorous (or obscurely bicolorous) scales and in its distinctly ruminate seeds. Owing to its indistinct ruminations Beccari was inclined to put C. marginatus in Group V rather than in Group IX, but in the absence of better developed seeds. I find it better to retain C. marginatus in Group IX. bases of the primary branches of the spadix of C. rostratus are also included for a greater part in the upper part (often split) of the spathe. Similar arrangement has not been observed in the two above mentioned Calami. In the living state the petiole and leaf rhachis are coloured golden yellow. The stem is not used by the Dusuns for tying purposes.

16. Calamus stramineus Furtado spec. nov.

Caudex scandens, circ. 7 cm. longus. Frondis vagina, ochrea et petiolus ignoti. Frondes magnæ ut videtur, cirrhiferæ, secus rhacheos dorsum unguibus armatæ. Segmenta ad 2 aggregata, gregibus oppositis vel fere

alternis, inæquidistantibus, lanceolata vel oblanceolata, utringue attenuata, apice acuminata, basi acuta, 25-35 cm. longa, 4-5 cm. lata, 5-9-costulata, secus leviter plicata, costis et nervulis transversis utrinque sat distinctis, glabra, in margine spinulosa, supra viridia, subtus fere glauca. Spadix foemineus longus, flagelliformis ut videtur. primariae partim visæ, tubulosæ; secundariæ tubulosæ, truncatæ, glabræ, decidue furfuraceæ. Spathellae spathis secundariis similes, sed minores, apice plerumque ciliolatæ. Rami primarii circ. 30 cm. longi, in apicem sterilem, 2 cm. longum exeuntes, utrinsecus spiculis circ. 8. Spiculae 4-7 cm. longæ, sessiles, utrinsecus fructus 6-13 gerentes. Involucrophorum sessile vel subpedicelliforme. Involucrum Perianthium fructiferum pedicelliforme, cupuliforme. calvee corollæ æquilongo. Fructus elliptico-ovatus, utrinque rotundatus, summo abrupte rostratus, cum caudiculo 0.15 cm. et rostro 0.3 cm. longo 1.8 cm. altus, 1 cm. in diam. Squamae stramineæ, secus marginem subconcolores, dorso canaliculatæ in orthostichis 15 dispositæ. Semen ovatum, 1 cm. longum, 0.6 cm. in diam., fere cylindricum, utrinque rotundatum, rhaphen secus prominens, ceterum irregulaalveolatum vel rugosum. Albumen profunde ruminatum. Embryo lateralis, proxime basin situs.

BRITISH NORTH BORNEO: Kinabalu Mts. near *Dallas*, alt. circ. 3,000 feet (Clemens no. 27010. Type in Singapore) *ibid* (Clemens n. 26496).

Evidently belongs to the *Group XIII of Beccari* and appears to be very near to *C. spathulathus* and *C. palembanicus*, but both these have seeds with homogeneous albumen. *C. Scipionum* has seeds with slight intrusions of the integuments in the albumen, but the leaflets here are equidistant (not arranged in groups). *C. densiflorus* bears distinctly ruminate seeds, but it has very narrow, linear, equidistant leaflets.

√ var. megalospermus Furtado var nov. A forma typica recedit spadicibus robustioribus, fructibus majoribus, squamis in orthostichis 17-18 dispositis, semine in latere foveali sat applanato.

BRITISH NORTH BORNEO: Kinabalu Mts., near Dallas, alt. circ. 3,000 feet (Clemens no. 27009. Type in Singapore).

The leaves in this specimen are apparently from very young shoots or plants and bear no thorns on the rhachis. The leaflets which are arranged in groups of 1-4 are papery in texture, narrower than in the type, green, concolorous, oblanceolate suddenly narrowed into a long acuminate apex, 3-5 costulate, spinulose along the costæ above and along the margins. In the duplicate preserved in the Berlin herbarium and bearing this number there is no trace of any

cirrus on the leaf, but the Singapore specimen which has somewhat older leaflets bears a very thin, filiform hooked prolongation at the apex. The lowermost spathe (secondary spathe) of the partial inflorescence in the type specimen bears also stout recurved spines, a fact which makes me surmise that the spadix in this species is flagelliform.

17. Calamus tenompokensis Furtado spec. nov.

Caudex scandens vel semiscandens, circ. 5 m. longus, sine vagina circ. 1 cm. in diam. Frondis vagina flagello carens (semper?), sensum in petiolum transiens, in parte superiore ventrali longitudinem secus breviter aperta, aculeis plus minus in seriebus transversalibus dispositis, valde applanatis, tenuibus, patentibus, cinnamomeis ad 2 cm. longis armata, decidue ferrugineofurfuracea. Ochrea brevissima, aculeis rigidis armata, in speciminibus junioribus lobis papyraceis caducis, 8-10 cm. longis Frondes cirrho carentes, cum petiolo 1-1.50 m. longæ, utrinsecus segmentis 6-9. Petiolus circ. 80 cm. longus, subtus convexus, aculeis robustis, solitariis vel confluentibus, patentibus vel reflexis, dispersis armatus, supra glaber, paulo concavus; rhachis aculeis solitariis. rarissime confluentibus, recurvatis subtus armata, circ. 50-70 cm. longa. Segmenta distantia, circ. 30 cm. longa. 4.5-5 cm. lata, inferiora alternantia, robuste-papyracea, latolanceolata, maxima latitudine in dimidia vel supra sita, basi attenuata, plicata, apicem versus subito vel potius sat subito acuminata, ad margines parce spinulosa, utrinque glabra, 5-7-stulata, nervulis transversis distinctis; terminalia ad 2/3 confluentia, sequentia ambo opposita vel sub-opposita, jugo terminalio valde approximata. Spadix foemineus fronde minor, apice sæpe flagelliformis, ramis secundariis patentibus, fructiferis 5-7 cm. longis. Spathae primariæ basin versus spinulosæ, in parte basilare tubulosæ, ad ramorum basin in lobos liberos exeuntes, longitudinem secus irregulariter fissæ, primariæ et ferrugineo-furfuraceæ. Rami prim secundariæ decidue Rami primarii et secundarii ad spatharum orificium orientes. Spathelae truncatæ, furfuraceæ, Involucrophorum sessile; involucrum calyculiforme. Perianthium explanatum, calyx quam corolla duplo vel subduplo brevior. Fructus ovoideus vel ellipsoideus utrinque rotundatus, apice in rostrellum 0.2 cm. longum abrupte productus, sine rostrello circ. 0.9 cm. longus, 0.7-0.8 cm. in diam. Squamae stramineæ, apice fuscæ, seriebus 18-21 verticalibus imbricatæ. Semen ambitum ellipsoideum, utrinque rotundatum, fovea chalazali laterali, nonnihil lateque impressum, ceterum applanatum, superficie sulcis latiusculis a fovea radiantibus pertensa, 0.7 cm. longum, 0.5 cm. latum, 0.4 cm. crassum. Albumen æquabile. Embryo in latere opposito proxime basin situs.

Planta mascula in frondibus ut fæminea. Spadix circ. 75 cm. longus, ramis primariis 5-7. Spathae et spathellæ ut fæmineæ. Spiculae graciles, circ. 4.5-6 cm. longæ, utrinsecus floribus circ. 15-20, distichis, alternantibus, valde approximatis. Involucrophorum sessile. Calyx tubulosus, trifidus, quam corolla 0.4 cm. longa subtriplo brevior.

BRITISH NORTH BORNEO: Kinabalu Mts: at Tenompok, towards Lumu Lumu, alt. circ. 5,500 feet (legit Furtado, comm. Clemens sub. no. 28408, female plant. Type in Singapore). *Ibid*, alt. circ. 4,500 feet (leg. Furtado, comm. Clemens sub. no. 29203, Male). *Ibid* towards Dallas, alt. circ. 4,000 feet (Clemens, no. 27339, male); ibid, alt. circ. 5,000 feet (Clemens, no. 27899, male).

This species belongs to Beccari's Group VI and is closely related to C. myriacanthus Becc which, however, has free apical leaflets, rusty scales on its petiole, rachis, and spathe and only rudimentary thorns or none at all on the spadices. The male spikelets in C. myriacanthus are also very much shorter. C. ramosissimus Griff. also bears some resemblance to C. tenompokensis, but the former is distinguished from the latter by its more numerous, leaflets, and by its leaves terminating into 3 (not 4) leaflets which are, moreover, always free to the base, whereas the two terminal leaflets in the other species are always connate.

INDEX TO THE COLLECTORS' NUMBERS

The Roman number following a collector's number indicates the species bearing that number in this paper. Thus "Clemens 26,496-XVI" means that the specimen bearing Clemens no. 26,496 is quoted under Calamus stramineus.

Burkill—s.n. (from Pulau Tioman)—II.

BURKILL AND HANIFF—13,446-VI; 13,451-VI.

BURKILL AND HOLTTUM-8,807-XI.

CLEMENS—26,496-XVI; 27,009-XVI var; 27,010-XVI; 27,339- and 27,899-XVII; 28,375-XV; 28,408-XVII; 28,566-XV; 28,844-XV; 29,195-VIII; 28.650-XV: 28,844-XV; 29,195-VIII 29,198a-IV; 29,203-XVII. 29.198

HANIFF—14,252-VI; 15,910-X; (Langkawi) s.n.-X.

HENDERSON—18.465-II.

HOLTTUM—10,974-XI; 15,211-II.

KJELLBERG-2,367-IX; 2,398-VII; 2,649-I.

MOORHOUSE—(from Kuala Pilah) s.n.- XI and XII.

Nur-11,130 and 12,188-XI.

RAMOS-1,400 and 1,788-XIV.

RIDLEY—(from Matang) s.n.-III; 9,207- and 9,814-XI; 11,215-V; 11,987-XI; 12,118-XII; 13,921-VI.

A NEW RHODODENDRON FROM GUNONG TAHAN

By Dr. J. J. Smith

Rhododendron Seimundii J. J. S., sp. nov.

Frutex innovationibus c. 6-0.7 cm. longis, ramulis teretibus, dense brevissime puberulis. Folia 5-10 in innovationum parte superiore alterna, remota, breviter petiolata, oblongo-obovata vel elliptica, interdum fere lanceolata, apice rotundata vel obtusa, sæpe distincte crasse apiculata, basi angustata acutiuscula vel acuta, sicco margine recurva crenulata, adulta supra glabra rugulosaque, subtus sparse lepidota plus minusve glabrescentia, deinde subtus et etiam supra præsertim versus basin impresse punctata, scrobiculis margine leviter elevatis. supra in utraque parte costæ mediæ supra sulcatæ subtus prominentis convexa, nervis lateralibus bene obtuse obsoletis, crasse coriacea, supra nitide nigro-fusca, subtus atrofusca, c. 1.25-2.8 cm. longa, 0.475-1.1 cm. lata; petiolus subteres, supra applanatus, dense minutissime puberulus lepidotusque, c. 0.2-0.4 cm. longus. Gemmæ floriferæ terminales, ovoideæ, c. 0.8-0.85 cm. longæ, ramentis exterioribus ovatis, obtusis, dorso dense pubescentibus lepidotisque, ciliolatis. Flores 2-4, pedicellati, pedicello cum ovario angulum obtusum faciente, tereti, sparse lepidoto, 0.9-1.2 cm. longo. Calyx obliquus inæqualiter 5-lobus, lepidotus. Corolla infundibuliformis, 5-fida. extus loborum margine lato glabro excepto sparse lepidota, intus glabra, secta et explanata flabelliformis, c. 1.9 cm. longa, limbo 2.6 cm. lato, tubo c. 0.8 cm. longo, basi 0.8 cm., apice 1.6 cm. lato, lobis obovatis, ut videtur interdum subretusis, c. 0.9-1 cm. longis, 0.6-0.7 cm. latis. Stamina 10, c. 1.8 cm. longa; filamentum lineare, glabrum; anthera supra basin dorsifixa, oblonga, basi obtusa, poris 2 oblique introrsis hians, c. 0.175 cm. longa. Ovarium breviter ovoideoconicum, obtusum, valde 5-angulato-canaliculatum, dense lepidotum, c. 0.225 cm. longum, 0.2 cm. diam.; stylus impositus, filiformis, basi lepidota excepta glaber, cum Discus stigmate capitato 5-lobulato 1.7 cm. longus. annularis, 10-lobulatus, glaber, 0.2 cm. diam.

MALAY PENINSULA: Pahang, Gunong Tahan, 5,500 ft. (E. Seimund, Nos. 159, 175, 343, 893, February—March, 1921).

Amongst the *Rhododendron* material which the Director of Gardens, Straits Settlements, very kindly sent me on loan for study, I found, partly under *R. spathulatum* Ridl., partly under *R. elegans* Ridl., specimens of the new species described above.

From the two species mentioned and also from *R. calocodon* Ridl. it is, apart from other characteristics, at once to be distinguished by the corolla, which is cleft to the middle in *R. Seimundii*, whereas in the others the lobes are much shorter than the tube.

Of the remaining Peninsular species with small leaves, viz. R. Scortechinii, King et Gamble, R. pauciflorum, King et Gamble and R. perakense, Ridl., I have seen no material. According to the descriptions, however, R. Seimundii is distinct from R. Scortechinii in the puberulous twigs, smaller leaves with obsolete nerves and fewer-flowered umbels, from R. pauciflorum in the puberulous twigs and petioles, not retuse leaves, more flowered inflorescences, lepidote pedicels, and from R. perakense in the puberulous not scaly twigs, narrower leaves with obsolete lateral nerves, larger flowers and a densely lepidote ovary.

Description from herbarium material.





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- 2. The Agricultural Bulletin of the High [Second Series, monthly issues] 1911. Most numbers are available p each or \$5 per volume.
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 - Vol. 2 208, 1-12, July 1918 August 1921
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& THE

GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. VIII w 23th October, 1835 Part 4

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THE

GARDENS' BULLETIN

STRAITS SETTLEMENTS

Vol. VIII

28th October, 1935

Part 4

NOTES ON MALAYAN DIPTEROCARPACEÆ—III

By C. F. Symington

These notes are a third contribution to the systematic study of the *Dipterocarpaceae* of the Malayan region.*

Nine species of Shorea and three of Hopea are included in this paper—the controlling factors in their selection being the urgency of the problem involved, the quality and quantity of material available, and an endeavour to follow as systematic a sequence as possible. Commencing with Shorea guiso (a species requiring considerable study), I have discussed three other related species—S. collina, S. ochrophloia, and S. Foxworthyi. Next I have given my arguments supporting the change in botanical name of a tree, hitherto known in the Malay Peninsula as Hopea dealbata, to H. Helferi. H. apiculata (a recently discovered species) has then been described and figured in some detail because of its botanical interest, and along with it is included H. resinosa, the only other representative of the Pierrea group known from the Malay Peninsula. Shorea bentongensis, the first member of the section Anthoshorea on which I have had occasion to publish notes, must stand alone in this paper as my manuscript on related species is not yet complete.

From Borneo, thanks to the efforts of the Forest Officers in British North Borneo, Sarawak, and Brunei, a large amount of excellent herbarium material of dipterocarps has accumulated since 1932. Much of this material is representative of undescribed, or little-known, species which require study and classification. A beginning is made in this paper with the descriptions of the new species *Shorea inaequilateralis*, S. albida, S. ochracea, and S. scabrida.

In this number, as in number 2 of this series, the citation of literature is more complete than in my first paper, because it seems desirable to record all the literature consulted, whether it be essential to the argument or not.

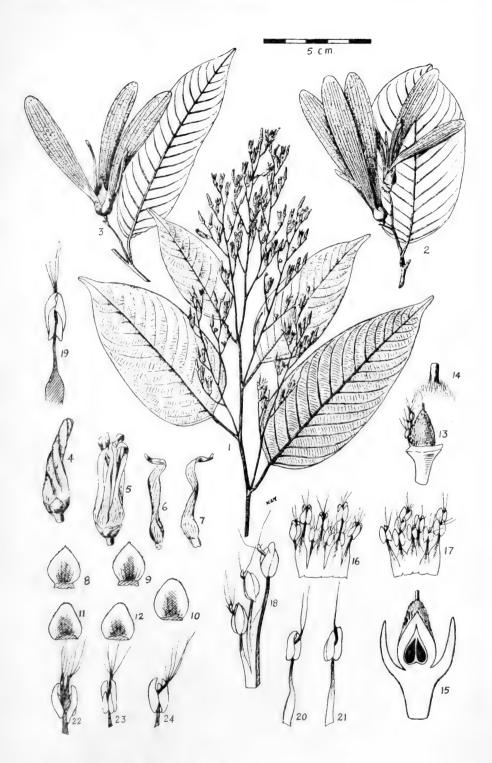
^{*} For previous papers see Gdns. Bull. S.S., Vol. VII, pp. 129-159 (1933), and Vol. VIII, pp. 1-40 (1934).

The concluding paragraph of the notes on each species is addressed, in particular, to forest officers.

I have, once more, to express my appreciation of the assistance willingly accorded by numerous institutions, botanists, and forest officers. In addition to those mentioned in the introduction to my last paper in this series I am particularly grateful to the Conservator of Forests, British North Borneo and the Conservator of Forests, Sarawak, for the loan of their entire collections of Dipterocarpaceae.

Shorea guiso (Blanco) Bl., Mus. Bot. Lugd.-Bat. 2: 34 (1852); Vidal, Sinopsis Atlas 15, tab. 15, f.C (1883); Brandis in Journ. Linn. Soc. 31: 89 (1895); Perk., Frag. Fl. Philip. 23 (1904); Merr. in Philip. Journ. Sci. 1, Suppl: 98 (1906), Spp. Blanco.: 270 (1918), et Enum. Philip. Fl. Pl. 3: 97 (1923); Foxw. in Philip. Journ. Sci. (Bot.) 2: 384 (1907), 4: 509 (1909), 6: 272 (1911), & 13: 191 (1918), et Mal. For. Rec. 10: 175 (1932) in obs.; Whitford in Philip. Bur. Forest. Bull. 10: 71, tab. 74 & 75 (1911); V. Sl. ex Merr., Univ. Calif. Pub. Bot. 15 (Pl. Elmer. Born.): 203 (1929); Desch in Mal. Forester 4: 29 (1935), in nota: Mocanera guiso Blanco, Fl. Filip. 449 (1837): Euphoria malaanonan Blanco, l.c. 286, non Shorea melaanonan Bl: Dipterocarpus guiso Blanco, op. cit. ed. 2: 313 (1845), et ed. 3, 2: 215 (1878): "Euphoria vel Nephelium" Blanco, op. cit. ed. 2: 200 (1845), et ed. 3, 2: 9 (1878): Anisoptera guiso A. DC., Prodr. 16, 2: 616 (1868): Shorea robusta F.-Vill., Novis. App. 21 (1880) non Gærtn.: Shorea vulgaris Lanessan, Pl. Utiles Col. Fr. 301 (1886); Pierre, Fl. For. Cochinch. Fasc. 15, tab. 232 (1890); Brandis in l.c. 81, tab. 2, 15 & 16 (1895); Guérin ex Lecomte Fl. Gén. Indo-chine 1: 380 (1910): Shorea Vidaliana Brandis in l.c. 83 (1895): Shorea Warburghii Perk. l.c. 23 (1904) non Gilg.: Shorea scrobiculata Foxw. in Philip. Journ. Sci. Bot. 13: 192 (1918) non Burck: Shorea longipetala Foxw., Mal. For. Rec. 10: 174, tab. 13 (1932): Sym. apud Desch in l.c. 28 & 29 (1935). Plate XVI.

Foxworthy has described this species under the name of S. longipetala but the following additional information may be helpful:—the leaves vary in size and shape through a much wider range than that described; there may be as many as 26 pairs of main nerves; the petioles are normally over 1.0 cm. long; the flowers may be almost sessile; the stamens vary in number (in the flowers I have examined) from 20 to 41; and the cilia on the appendages from 1 to



Shorea guiso (Bleo.) Bl.



8. The *fruits*, of which I have seen only one really mature collection (C.F. 9508), may be described as follows:—stalk 1.5 mm. long, stellate-puberulous; calyx lobes swollen and woody at the base, closely appressed to one another, enclosing rather less than half of the nut, puberulous; three large wings linear-spathulate, 6.0–7.0 cm. \times 0.9–1.2 cm., about 8-nerved; two small wings linear, about 3.5 cm. \times 0.2 cm., 3 to 5-nerved; nut about 1.3 cm. \times 0.8 cm., sericeous-tawny tomentose, terminated by a tomentose beak which is 4.0 mm. long.

This species was first described by Blanco from Philippine material in 1837 under the name of Mocanera guiso. This name he altered to Dipterocarpus guiso in subsequent editions of his "Flora de Filipinas". Under the names Euphoria malaanonan and "Euphoria or Nephelium" Blanco described sterile, galled collections of the same plant. Fernandez-Villar (1880) considered this to be Shorea robusta Gærtn.—an error rectified by Merrill in 1918 when he established the true identity of Euphoria malaanonan in his "Species Blancoanæ".

The combination *Shorea guiso* was first made by Blume in 1852. In 1868 De Candolle placed the species in *Anisoptera*, but, in 1895, Brandis again reverted to *Shorea*, to which genus it obviously belongs.

In 1886 this species was discovered in lower Cochinchina and named *Shorea vulgaris* by Lanessan. Pierre described and figured the species in some detail in his Forest Flora of Cochinchina in 1890. His descriptions and figure are slightly inaccurate in some respects (notably in the large number of hairs on the appendage) but examination of the Kew sheets of Pierre's type specimen (1727) convince me that it is conspecific with *Shorea guiso*.

Later Philippine collections were described as *Shorea Vidaliana* by Brandis in 1895, and referred to *Shorea Warburghii* Gilg. by Perkins in 1904. I have not had the opportunity of examining these collections, but I have included them in my synonymy on the authority of Merrill and other Philippine botanists. Another Philippine collection (22712) was referred to *Shorea scrobiculata* Burck by Foxworthy in 1918. I am in agreement with Merrill who has identified it with *Shorea guiso*.

Our collections from the Peninsula date from 1918 and were described by Foxworthy in 1932 as Shorea longipetala. At the time Foxworthy was aware of the close affinity of S. longipetala and S. guiso, and suggested that reduction might be necessary. Shorea guiso was collected

in British North Borneo by Elmer in 1923 (vide V. Sl. ex Merr., Pl. Elmer. Born.) and in Peninsular Siam by Foxworthy in 1930. The latter collections are here recorded for the first time.

Collections examined:-

COCHINCHINA: Pierre 1727 (Auth. spec. of Shorea vulgaris Lanessan).

SIAM: S'pore 24236 & 27239.

MALAY PENINSULA:

KEDAH: C.F. 17788, 27379, & 27400.

KELANTAN: C.F. 32723, 32731, 32732, 32830, 33263, 33264, 33406, & 33452.

PERAK: C.F. 0132, 0138, 8334, 10258, 10354, 10424, 11596, 16703, 25443, 25747, 29018, 29019, 29875, 30741, & 30802.

DINDINGS: C.F. 16802 & 27843. TRENGGANU: C.F. 26929 & 26933.

Pahang: C.F. 1277, 4503 (Auth. spec. of *Shorea longipetala* Foxw.), 4856, 5447, 7932, 9508, 13797, 15627, 17242, 17334, 23361, 26033, 26035, 27994, 28324, 29378, 29961, & 37316.

SELANGOR: C.F. 12065, 23086, 23329, 24203, 24245, 25168, 33556, & 33895.

NEGRI SEMBILAN: C.F. 12837, 12849, 18199, 20135, 24304, & 26614.

MALACCA: C.F. 25286.

British North Borneo: C.F. 38836 (S.H. No. 4460).

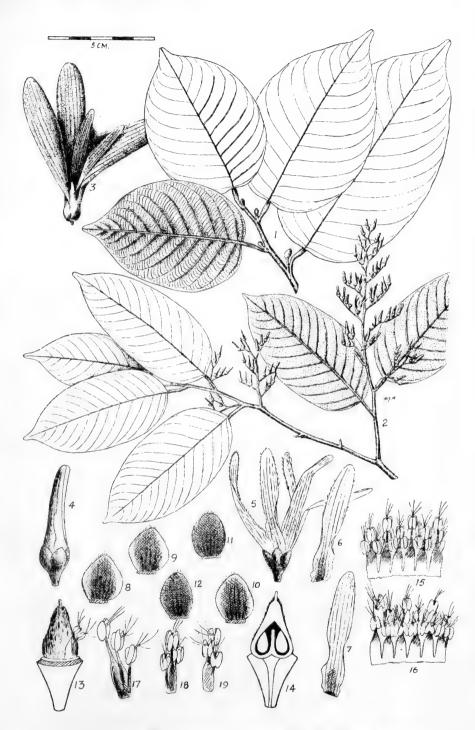
PHILIPPINES: Bur. Sc. Philip. 2865, 7344 & other colls. at Kew, 11773, 27136, 27373, & 29063. Merr. Spp. Blanco. no. 407.

The tree, for which the preferred name of *membatu* is given in our list of Botanical Equivalents, was described as *Shorea longipetala* in 1932. This species is here shown to be the same as *Shorea guiso* of the Philippines and *Shorea vulgaris* of Cochinchina. The oldest name *Shorea guiso* must, in future, be adopted for our species, which, it is interesting to note, extends from Cochinchina through Siam, the Malay Peninsula, and Borneo, to the Philippines.

Shorea ochrophloia E. J. Strugnell (Ms.) sp. nov.; Sym., apud Desch in Mal. Forester 4: 28, nomen. Plate XVII.

Ab affine S. guiso (Blco.) Bl., ramulis crassioribus, foliis tomentosis crassioribus, paniculis densioribus facile distinguenda.

Branchlets densely fulvous stellate-tomentose when young; later glabrescent, black. Leaves ovate, elliptic-ovate,



Shorea ochrophloia E. J. S. ex Sym.



ovate-oblong, usually shortly blunt-or mucronateacuminate at the apex, rounded or subcordate at the base, margins subrevolute, average size about 7.0 cm. \times 5.0 cm. but very variable, glabrous (except on midrib) and usually drying yellow- or red-brown above, fulvous tomentose on the nerves beneath; midrib slightly depressed and tomentose above, strongly elevate and stellate-tomentose beneath; main nerves 13 to 17 pairs, slightly depressed above, strongly elevate and stellate-hairy beneath; nervules joining the main nerves in parallel curved lines, inconspicuous above, conspicuous and stellate-hairy beneath; petioles terete, thicker in the upper portion, 0.8–2.0 cm. long, fulvous tomentose; stipules oblong-obtuse, subfalcate, 6.0 mm. × 3.0 mm., tomentose on both surfaces, caducous. Panicles axillary and terminal, lax; main axis usually less than 5.0 cm. long, fulvous tomentose; ultimate branchlets about 5.0 mm. apart, 1.0-2.0 cm. long, grey tomentose, each bearing 2 to 6 secund flowers. Flowers 2.0-3.0 mm. apart, elongate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, grey tomentose. Sepals ovate-obtuse, subequal, densely tomentose outside, glabrous inside. Petals linear, pale-sericeous tomentose outside, "creamy-white with a purple-red patch inside at the base" (Symington, C.F. 30735), falling separately. Stamens 26 to 30 (in flowers examined), of three heights, arranged in 3's (vide plate XVII, 15 & 16); anthers elliptic-oblong, posterior cells slightly smaller than the anterior; filaments 2 to 4 times as long as anthers, broad at the base, narrow in the upper half; appendage to connective less than half the length of the anther, blunt, becoming reflexed, with 3 to 5 (usually 3) fine hairs. Ovary ovate, narrowed above, densely sericeous tomentose; style short, cylindric, glabrous; stigma not enlarged. Fruit—a 5-winged nut: stalk 2.0 mm. long, stellate-puberulous; bases of accrescent calyx wings thickened and woody, enclosing one half of the nut, stellatepuberulous; three outer wings linear-spathulate, narrowed to the base, 5.0-7.0 cm. long imes 1.3-1.5 cm. broad, 7 to 8-nerved, puberulous in the lower portions, red-brown; two inner wings smaller, linear, about 4.0 cm. \times 0.5 cm., 5 to 6-nerved; nut ovate, rostellate, about 1.5 cm. \times .7 cm., pale tomentose; rostellum up to 5.0 mm. long, densely tomentose.

Shorea ochrophloia is a typical member of the section Eushorea. In flower characters it is almost indistinguishable from Shorea guiso (Blco.) Bl. (vide p. 266), but the coarser and hairer leaf is a simple diagnostic character.

The epithet *ochrophloia*, given in manuscript by Mr. E. J. Strugnell, is descriptive of the yellow-brown colour characteristic of the bole of this tree.

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Collections examined:—

MALAY PENINSULA:

KEDAH: C.F. 27482 (Type of flower of S. ochrophloia E.J.S.).

KELANTAN: C.F. 33356.

PERAK: C.F. 25634, 27250, 29016 (Type of fruit of S. ochrophloia E.J.S.) 29017, 29020, 30735, & 30923.

TRENGGANU: C.F. 26882.

Pahang: C.F. 10628, 26032, 26048, 26219, 27884, & 29962.

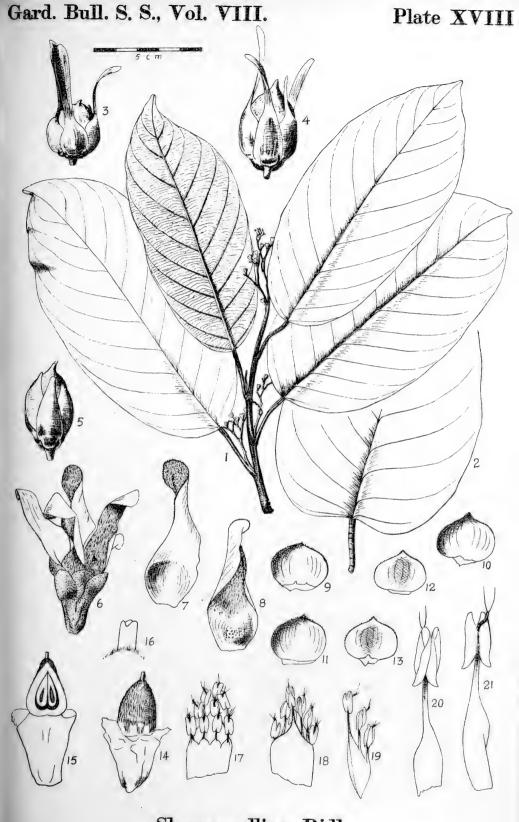
SELANGOR: C.F. 22964 & s.n. (Mitchell, 1st. Aug., 1918).

NEGRI SEMBILAN: C.F. 12838, 20851, & 32690.

Shorea ochrophloia is a little-known species that is here described for the first time. It appears in our list of Botanical Equivalents under the vernacular name of seraya batu. The tree appears to have a wide distribution on low hills throughout the Peninsula but it is not known to be common anywhere. The timber is placed by Mr. Desch (Mal. Forester 4: 28) in the damar laut merah grade.

Shorea collina Ridl. in Agri. Bull. S.S. & F.M.S. 9: 182 (1910), et Fl. Mal. Penins. 1: 231 (1922); Burn-Murdoch, Trees and Timbers Mal. Penins. 1: 13, tab. (1911); Heyne, Nutt. Pl. Ned. Ind. 3: 299 (1917), 2nd edit. 3: 1116 (1926); Foxw., Mal. For. Rec. 3: 63 (1927) partim, et Mal. For. Rec. 10: 173 (1932) partim; non Sym. apud Desch in Mal. Forester 3: 195 (1934): Shorea angustiloba Foxw., Mal. For. Rec. 10: 168, tab. XI (1932); Sym. in l.c. (1934), et l.c. 4: 26 (1935). Plate XVIII.

Branchlets flattened when young, dark purple to black, usually with a few minute stellate hairs; later terete, black. Leaves broadly elliptic or ovate to elliptic-oblong, shortly blunt-acuminate at the apex, rounded to subcordate (sometimes subequal) at the base, usually about 7.0 cm. ×13.0 cm. but varying between wide limits, glabrous (except for the midrib) and usually drying dull grey above, glabrous and usually red- or purple-brown beneath; midrib slightly sunk and fugaceous-tomentose above, strongly elevate striate glabrescent beneath; main nerves about 12 pairs, strongly elevate on the lower surface, inconspicuous above; nervules joining the main nerves in fine parallel lines, with fine reticulations between them, distinct beneath, less conspicuous above; petioles thick, rugose, slightly swollen in



Shorea collina Ridl.



the upper portion, 2.0-3.0 cm. long, black, glabrescent; stipules caducous (not seen). Panicles axillary and terminal, main branches thin, 2.0-4.0 cm. long, puberulous, black; lateral branchlets less than 1.0 cm. long, puberulous, each bearing 1 to 3 flowers. Flowers about 2.0-3.0 cm. apart, about 8.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, rugose, tomentose. Sepals rotundate. apiculate, two slightly smaller than the other three, tomentose outside, glabrous inside. Petals oblong to linearoblong, broader at the base, pubescent outside, glabrous inside. Stamens 55 (one flower only examined), of several sizes—the inner row twice as high as the outer; anthers oblong, posterior cells smaller than the anterior; filaments one to four times as long as the anthers, broad and subgibbous below (particularly the inner row), suddenly narrowing to the filamentous upper portion; appendage to connective about one half the length of the anther, slightly reflexed, with 2 to 5 bristles. Ovary ovate, densely setose; style short, cylindric, glabrous; stigma minute, slightly 3-notched. Fruit—a nut with 5 rudimentary wings; stalk 3.0-5.0 mm. long, stellate-puberulous; bases of calyx lobes thickened, woody, pale fagaceous-tomentose, red-brown beneath, enclosing half of the nut; three large outer wings irregular in size, linear-oblong, up to 4.0 cm. \times 1.0 cm. but usually smaller, puberulous, red-brown, about 7-nerved; two inner wings linear, 1.5 cm. or less $\times 3.0$ –4.0 mm., about 4-nerved; nut ovate-orbicular, rostellate, 2.5-4.0 cm. × 2.0-3.0 cm., pale tomentose; rostellum up to 7.0 mm. long.

Shorea collina was first described by Ridley from a fragmentary flowering specimen (319) collected in 1910 by A. E. Sanger-Davies in Rompin, Pahang, under the vernacular name of balau bukit. In 1927 and 1932 Foxworthy added notes under the heading of S. collina, but the additional collections, upon which his information was based, belonged to a closely related, but different, species which I am naming Shorea Foxworthyi. This latter species has, for some years been considered to be S. collina by members of the Forest Department and has been wrongly so named by me in l.c. Collections of the real S. collina, made subsequent to 1910, were not recognised as such, but were redescribed under the name of Shorea angustiloba Critical study of the one complete flower Foxw. in 1932. remaining upon our type sheet of S. collina, and comparison with a recently acquired collection of flowers of the species confused with it, have enabled me to correct this error. Unfortunately the type sheet, which is the only known collection of flowers, is too fragmentary to give a very good idea of the inflorescence.

S. collina, which clearly belongs to the section Eushorea, is remarkable in the number of stamens, the shape of the filaments, and the large, short-winged nut. The flower structure is very similar to that of a species erroneously considered by Philippine botanists to be Shorea balangeran (Korth) Dyer ex Vidal (vide p. 273). These species (S. collina and S. balangeran Auct. non Dyer) are, however, readily distinguishable on vegetative and fruiting characters.

Collections examined:—

MALAY PENINSULA:

TRENGGANU: C.F. 26700, 26730, & 26909.

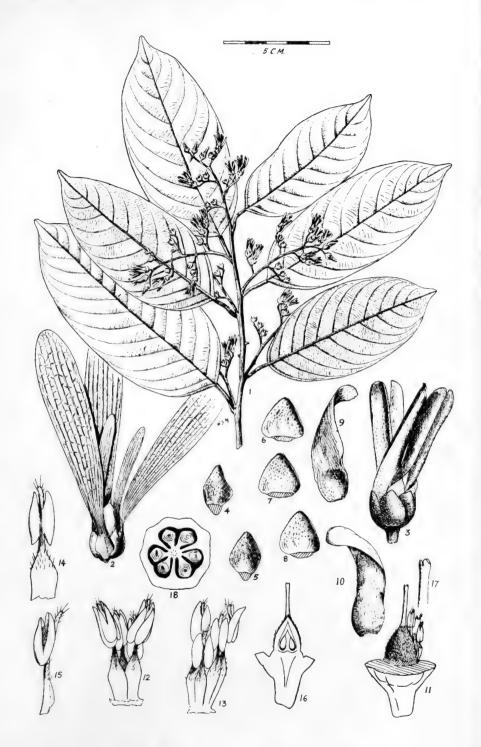
Pahang: C.F. 319 (Type of S. collina Ridl.), 6672, 8103, 8117, 8171, 8184, 8186, 9509 (Type of S. angustiloba Foxw.), 17351, 27888, 27940, & 29336.

This is the tree known as balau merah in Pahang East. It was described as Shorea angustiloba in Mal. For. Rec. 10 owing to misinterpretation of the collection described by Ridley in 1910 as Shorea collina. S. angustiloba now lapses into synonymy and our balau merah becomes Shorea collina (c.f. notes on Shorea Foxworthyi, p. 274).

Shorea Foxworthyi Symington sp. nov. Shorea collina Foxw., Mal. For. Rec. 3: 63 (1927), et Mal. For. Rec. 10: 173 (1932) (excl. 319), non. Ridl. in Agri. Bull. S.S. & F.M.S. 9: 183 (1910); Sym., apud Desch in Mal. Forester 3: 195 (1934) non Ridl. Plate XIX.

Shorea collinae Ridl. affinis, sed filamentis ciliatis, ciliis appendiculorum numerosioribus, stylo longiore, nuce parviore, segmentis calycis fructiferi longioribus differt.

Branchlets slightly flattened when young, grooved, minutely dense fulvous tomentose; later glabrescent, black. Leaves elliptic, elliptic-oblong, ovate-lanceolate, or subovate, acuminate and blunt or mucronate at the apex, rounded to subcordate at the base, usually about 11.0 cm. ×5.0 cm., glabrous and normally drying chocolate-brown apparently glabrous (except on the midrib and main nerves) but actually minutely lepidote and yellow-brown or red-brown beneath; midrib slightly sunk above, strongly elevate, striate, puberulous beneath; main nerves usually 11 to 14 pairs, strongly elevate on the lower surface, not raised and comparatively inconspicuous above; nervules joining the main nerves in numerous wavy lines, fine (but conspicuous) beneath, less conspicuous above; petioles grooved, thicker in the upper portion, of similar texture to the young branchlets; stipules oblong, subfalcate, rounded at the apex, 15.0 mm. \times 3.0 mm., sericeous inside, coarsely fulvous



Shorea Foxworthyi Sym.



stellate-tomentose outside, caducous. *Panicles* axillary and terminal; main axis stout, grooved, up to 5.0 cm. long, fulvous tomentose; lateral branchlets 4.0 mm. apart, regularly alternating, less than 1.0 cm. long, tomentose, each bearing 1 to 3 secund flowers. Flowers about 3.0 mm. apart, ovate-lanceolate in bud, about 1.0 cm. long (including the pedicel); pedicel about 1.0 mm. long, grey tomentose. Sepals ovate, obtuse, two slightly smaller than the other three, grey tomentose outside, glabrous inside. Petals linear-oblong, slightly contorted in bud, pubescent outside, glabrescent inside, yellow (M. L. Webber, C.F. 30301). Stamens 33 to 41 (in flowers examined), arrangement somewhat obscure; anthers oblong, posterior cells smaller than the anterior; filaments as long as to twice the length of the anthers, broad at the base, slightly broader and setose about the middle, narrow at the apex; appendage to connective oblong, about half as long as the anthers, with 7 to 12 unequal bristles. Ovary hemispherical, narrowed above, densely setose; style as long as the ovary, cylindric, glabrous, stigma slightly enlarged, obscurely 3-notched. Fruit—a 5-winged nut: stalk about 1.0 mm. long, sparsely stellate-hairy; bases of the calyx lobes thickened and woody, enclosing less than half of the nut, sparsely stellate-hairy; three outer wings large, oblong-spathulate, narrowed at the base, 9.0-14.0 cm. × 2.0-3.0 cm., glabrescent, shining red-brown, 9 to 11-nerved; two inner wings smaller, linear, usually about 5.0 cm. \times 0.6 cm. but very variable, about 3 to 6-nerved; nut ovoid, rostellate, about 2.2 cm. imes 1.7 cm., pale tomentose; rostellum up to 4.0 mm. long.

The first collection of this species (C.F. 9507) was made by F. W. Foxworthy in Baloh Reserve, Kuantan, in 1923. This, along with subsequent collections of the species, was identified by him with Ridley's *Shorea collina*, and in 1932 he described the fruits of 9507 as the fruits of *S. collina*. This error has been repeated in Mal. Forester 3: 193 and other Forest Department publications.

I am now renaming the species *Shorea Foxworthyi*. It is very closely related to *S. collina* Ridl., but the flowers differ in the ciliate filaments, the more numerous cilia on the appendages, and the longer style. The fruits, of course, although essentially similar, differ very markedly in size and in the nature of the calyx wings.

From the Philippines I have seen three sheets (For. Bur. No. 27099, 27381*, & 31057) that are remarkably similar to S. Foxworthyi in vegetative characters. Floral

^{* 27099 &}amp; 27381 are cited in Merr. Enum. Philip. Pl. 3: 96 (1923) as $Shorea\ balangeran$ (Korth.) Dyer ex Vidal, but it is very evident that they are not that species.

dissection of 27099, however, shows that the species is quite distinct, although clearly a member of the same group.

Collections examined:-

MALAY PENINSULA:

Perak: C.F. 4570, 5386, 8839, 14376, 24492, 24613, 24614, 24616, 24631, 24637, 24646, 24822, 25416, 28063, 28804 (Type of fruit of S. Foxworthyi Sym.), 29041, 29704, 30301 (Type of flower of S. Foxworthyi Sym.) 30677, 30814, 30895, 31041, 31044, 31084, 32176, 33901, 33902, 33903, 33904, 33905, 33906, & 41560.

TRENGGANU: C.F. 26685, 26712, 26731, 26736, & 26911.

Pahang: C.F. 1683, 6828, 9507 (Type of fruit of S. collina Foxw. non Ridl.), 14902, 17221, 17222, 28801, & 29664.

JOHORE: C.F. 12059.

This is the species for which the preferred name in the Federated Malay States is balau bukit. For some years it has been known to Malayan forest officers as Shorea collina. It is here shown that this is an error/resulting from the misapplication of the name Shorea collina, which rightly belongs to our balau merah—a species redescribed in Mal. For. Rec. 10 as Shorea angustiloba.

Hopea Helferi (Dyer) Brandis in Journ. Linn. Soc. 31: 62 (1895) tab. 2, 1 & 2, et Ind. Trees 67 (1911); Fischer in Kew Bull. 1927: 206; Sym. in Gdns. Bull. S.S. 8: 22 (1934), in obs.: Vatica Helferi Dyer in Hook. f. Fl. Brit. Ind. 1: 302 (1874); Shorea Helferi Kurz, For. Fl. Brit. Burma 1: 119 (1877); Hopea dealbata Hance in (London) Journ. Bot. 15: 329 (1877); Lanessan, Pl. Utiles, Col. Franc. 300 (1886); Pierre, Fl. For. Cochinch. fasc. 16, tab. 246 (1890); Heim, Recherch. Diptéroc. 61 (1892), in obs.; Brandis in Journ. Linn. Soc. 31: 62 (1895); Guérin ex Lecomte, Fl. Gén. Indo-Chine 1: 374 (1910) icon. 36; Lecomte, Bois l'Indo-Chine 110 (1926) tab. 32; Foxw., Mal. For. Rec. 10: 128 (1932). Plate XX.

Published botanical descriptions and figures of this species, being based on inadequate material, are not very satisfactory. I have therefore prepared the following:—

Branchlets dark purple-black, pale fugaceous-tomentose towards the ends. Leaves oblong or elliptic-oblong, apex blunt, acute, or subacuminate (but frequently damaged), base equal to markedly unequal and cuneate to cordate, usually about $16.0 \text{ cm.} \times 6.0 \text{ cm.}$ but varying between wide





limits, coriaceous, yellow- or light red-brown, glabrous above, pale yellow or silvery (densely minutely lepidote) beneath; midrib slightly depressed above, strongly elevate striate fugaceous-tomentose beneath; main nerves about 13 to 17 pairs, usually inconspicuous above, elevate beneath; nervules joining the main nerves in numerous, more or less parallel, lines, conspicuous only on the lower surface; reticulations minute; petioles 0.5–1.3 cm., thick, rugose, channeled above, black, glabrous when old; stipules linear, caducous (seen only on immature specimens). Panicles axillary and terminal, racemose, when mature about as long as the leaves, pale tomentose; ultimate branchlets about 7.0 mm. apart, 1.0-3.0 cm. long, each bearing 4 to 12 secund flowers; bractioles small, caducous. Flowers about 2.0 mm. apart, subovate in bud, about 5.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, sericeous tomentose. Sepals imbricate; two oblong-obtuse, thick, tomentose (except on the posterior basal portion); three ovate-acute or acuminate, thinner, tomentose outside only. contorted in bud, elliptic-oblong, fimbriate at the apex, tomentose outside on the portion exposed in bud, pale yellow (Parkinson, 5199). Stamens 15, three appressed to each petal; anthers ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as anthers, broad and overlapping at the base, filamentous above; appendage to connective filiform, about one and a half times as long as the anther. Ovary broadly cylindrical-truncate, constricted in the middle, glabrous, the upper (stylopodial) portion sometimes subpapillose; style about one quarter the length of the ovary, cylindrical; stigma minute. Fruit: stalk 1.5 mm. long, pale tomentose; calyx lobes appressed at the base to the lower third of the nutlet; two large lobes linear-spathulate blunt, about 5.5 cm. imes 1.0 cm. to 8.0 cm. imes 2.0 cm., shining light brown, puberulous at the base, about 9-nerved; three small lobes ovate-acute, about 4.0 mm. imes 3.0 mm., puberulous outside, less than one half the length of mature nut; nut ovate, apiculate, about $8.0 \text{ mm.} \times 6.0 \text{ mm.}$, striate, glabrous, shining. *Embryo* as in *Hopea sangal* Korth.*

This species was first described by Dyer in 1874, from a collection (No. 716) made by Helfer at Mergui in Tenasserim. The type collection, of which I have seen the

^{*} The normal embryo of *H. Helferi* is almost indistinguishable from that of *H. sangal*, but I have not noted any instance of multiple ovule development—a common feature of *H. sangal*. I might note here that, just before germination, the nutlets of this group become slightly inæquilateral, owing to the irregularly exerted pressure of the swelling embryo which finally ruptures the pericarp in an indeterminate fashion. This is a very different mode of germination from that of the *Pierrea* group (vide Gdns. Bull. S.S. 8: 32).

Kew and Calcutta sheets, bears flowers and has leaves with cordate, unequal bases. The systematic position of the plant seems to have puzzled several authors. Dyer originally referred it to *Vatica* in 1874, Kurz removed it to *Shorea* in 1877, while Brandis placed it in its present genus, *Hopea*, in 1895.

In 1877, Hance described a fruiting collection, of what he thought to be a new species from Cambodia, as *Hopea dealbata*. He cited no specimen, but Pierre, enlarging upon Lanessan's description in 1890, cited No. 1457, a sheet of which is at Kew. Although this sheet bears fruits only, and has truncate to subcuneate leaves, I am uniting it with *Hopea Helferi** without hesitation. A number of collections of the species, mainly from Burma and the Malay Peninsula, has accumulated of recent years. Some of these are an excellent match for *H. Helferi* and some for *H. dealbata*, while others are representative of gradations between the two. In examining this herbarium material one cannot but be impressed by the superiority of leaf texture over leaf shape as a diagnostic character.

Pierre, Heim, Brandis, and Foxworthy all refer the species to the *Euhopea* section of the genus. With this, as stated in op. cit. (1934), I am in entire agreement.

Collections examined:

Burma: Helfer 716 (Auth. Spec. of *Vatica Helferi* Dyer); Maymyo Nos. 7605 (Field No. 1929), 8329 Field No. 5199), & 12198 (Field No. 11049).

CAMBODIA: Pierre 1457 (Auth. Spec. of *Hopea dealbata* Hance).

SIAM: Foxworthy 11; S'pore 24235.

MALAY PENINSULA:

Langkawi: C.F. 7558, 7559, 7678, 7697, 8962, 12401, 20763, 20768, 21046, & 21462.

PERAK: C.F. 7048, 10406, 10413, 10235, 10417, 29043, 30806, 30917, & 30919.

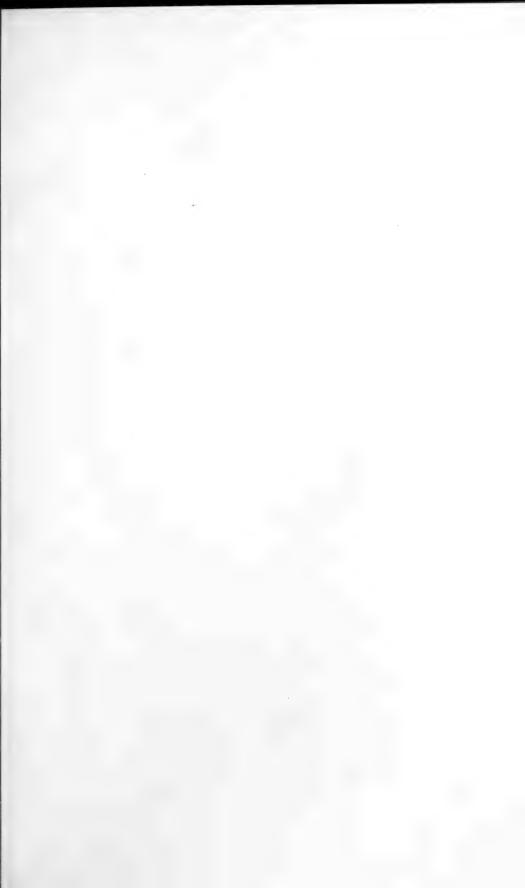
Hopea Helferi is the tree known as lintah bukit on the island of Langkawi. It is probably better known in Burma, Cambodia, and Siam than it is with us, having been found in the Peninsula only as far south as Lenggong in Upper Perak. The botanical name Hopea dealbata Hance (the Cambodian name) has been given to the tree in Mal. For. Rec. 10, but the species is shown to be conspecific with the species described earlier from Burma, and the older epithet is chosen in accordance with the rules of botanical nomenclature.

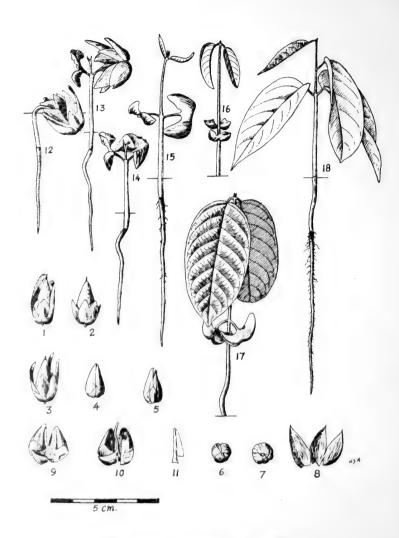
^{*} The union was first proposed by me in Gdns. Bull. S.S. 8: 22 (1934).





Hopea apiculata Sym.





Hopea apiculata Sym.

Hopea apiculata Symington, sp. nov. Plates XXI & XXII

Species H. laxae Sym., H. resinosae Sym., H. pachy-carpae (Heim) Sym., etc. affinis, nuce parvo, glabro, apiculato, segmentis brevibus chartaceis instructo, differt.

Branchlets dark purple but usually covered with a pale tomentum, with decurrent elevate lines from the insertion Leaves lanceolate or oblong-lanceolate. of the petiole. gradually tapering to the acuminate apex, base subequal, rounded, or subcordate, about 13.0 cm. × 3.5 cm. to 21.0 cm. × 6.0 cm., glabrous on both surfaces (except midrib and main nerves above), pale yellow-brown (sometimes with a green tinge) above, stramineous (or glaucescent) beneath (v.s.); midrib slightly depressed and tomentose above, strongly elevate beneath; main nerves 11 to 14 pairs, at an angle of about 45° to the midrib, inconspicuous but tomentose above, elevate beneath; nervules joining the main nerves in fine more or less parallel lines, almost invisible above, distinct beneath; petioles 7.0-10.0 mm. long, terete, rugulose, tomentose; stipules caducous (not seen). Panicles axillary (sometimes in axils of recently fallen leaves) or terminal, usually solitary (rarely 2), 4.0-20.0 cm. long (usually a little shorter than the leaves), lax, stramineous, glabrous; branchlets about 1.5 cm. apart, each bearing 2 to 5 (usually 4) secund flowers. Flowers about 4.0 mm. apart, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0 mm. long, minutely lentiginose. Sepals minutely subciliate along the apical margins, otherwise glabrous; two outer ovate-acute; three inner slightly larger, ovate-acuminate, hyaline at the edges. Petals oblongoblique, tomentose on the portion exposed in bud "yellowish when fresh" (Wilkinson). Stamens 15, pairs alternating with single stamens; anthers oval, posterior cells slightly smaller than the anterior; filaments 1 to 3 times as long as the anthers, broad and flattened below, gradually narrowing to the filamentous upper portion; appendage to connective filiform, slightly longer than the filament and anther. Ovary with stylopodium shaped somewhat like an hour glass, glabrous; style short, glabrous; stigma minute, apparently simple. Fruit: stalk 1.0 mm. long or less, puberulous; calyx lobes chartaceous above, woody in the lower portion, shortly united at the base to form a woody receptacle, all glabrous; three inner lobes ovate-acute (sometimes obtuse or acuminate), about 11.0 mm. × 6.0 mm.; two outer lobes ovate-oblong to linear-oblong, obtuse at the apex, tending to curve inwards, usually unequal in size, 1 to 2 times as long as the inner lobes but rarely longer than the nut; nut ovate-conical, about 1.7 cm. × 1.0 cm.,

sparsely puberulous to glabrous, surmounted by a prominent apicula about 2.0 mm. long. *Embryo* essentially as in *Hopea pachycarpa* (Heim) Sym.

This extremely interesting species, which was collected for the first time in 1935, is the second member of the *Pierrea* group of *Hopea** from the Peninsula. The fruits are peculiar—they are intermediate between the "Balanocarpus" (wingless) type and the "Hopea" type with two long wings. Another peculiarity is the entire absence of the resinous exudation commonly found cementing together the base of the nut and the bases of the sepals of species in the group.

Collections examined:—

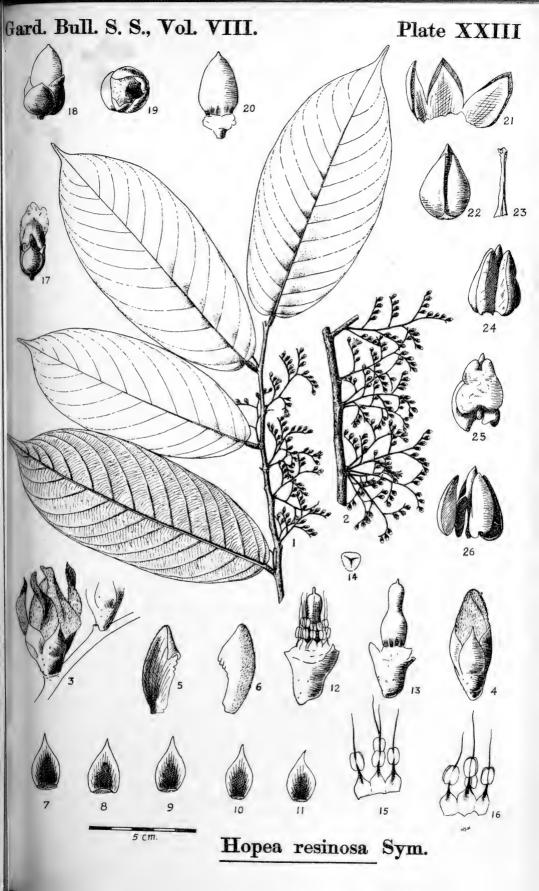
MALAY PENINSULA:

PERAK: C.F. 30322 (Type of flower of *H. apiculata* Sym.); G. Wilkinson; Compt. 8, Kenas Circle, Bubu Reserve, flat land; 29th Jan. 1935; flower. Field Note by Mr. Wilkinson—"Tree, height 50–75 feet; first branch 35–45 feet; diam. breast high 9–12 in., crown dense, spherical; bark white and black, smooth (one tree was fissured—fissures from small 2 in. cracks to 12 in. deep vertical gashes); buttresses absent to 3 feet in height; bark ½ in. and over; stem not usually absolutely straight, tapers to 8" diam. at first branch; branches many and much forked, leave the stem pointing slightly upwards but are pendulous after half their length; regeneration very dense, leaves of seedlings larger than those of mature tree." C.F. 16828, 39104, 39105, & 39106 (Type of fruit of *H. apiculata* Sym.).

Hopea apiculata is a "new" species recently discovered by Mr. Wilkinson in Bubu, and Mr. Carcenac in Bruas, Forest Reserves. Both officers report that the tree regenerates prolifically but that it does not attain large dimensions. The timber appears to approach "balau" in quality and the species may be useful as a pole crop. The leaves are very similar to those of chengal (Balanocarpus Heimii) and Mr. Carcenac reports that these species are commonly confused in young stages. The only vernacular name so far reported for H. apiculata is resak, but this is hardly appropriate and should not be encouraged.

Hopea resinosa Symington, nom. nov.: Balanocarpus pubescens Ridl., Fl. Mal. Penins. 1: 247 (1922); Foxw., Mal. For. Rec. 10: 147 (1932); Sym. in Gdns. Bull. S.S. 8: 28 & 32 (1934), in obs. Plate XXIII.

^{*} Vide Gdns. Bull. S.S. 8: 27 & 32 (1934).





This species was first collected in the Kuantan district of Pahang by Forest Ranger Yeop, in 1919. Ridley examined this collection (of fruit only) and described it as *Balanocarpus pubescens* in 1922. Foxworthy, with additional material, gave a more complete description in 1932.

I have already discussed the systematic position of this plant in *loc. cit.* I have stated that the species is a typical member of the *Pierrea* group of *Hopea* and is very close indeed to *Hopea pachycarpa* (Heim) Sym. In making the transfer to *Hopea* a new specific name must be given, *Hopea pubescens* being already occupied.

Foxworthy's description, together with the plate published with this paper, should provide adequate definition of I might add some remarks concerning the species with which H. resinosa is most liable to be confused in the herbarium, i.e. H. pachycarpa and H. philippinensis. In all essential characters H. resinosa is almost identical with the former, but may be distinguished without difficulty by the facies of the dried specimen. In H. pachycarpa the leaves are more coriaceous and more glabrous, have somewhat thicker petioles and less distinct reticulations, and dry chocolate-brown above as opposed to pale green in *H. resinosa*. The dried sterile specimen of *H. resinosa* has a facies very like that of H. philippinensis, but may be distinguished by the less inæquilateral leaf and the absence of domatia in the nerve axils. Fruiting material is, of course, quite distinct, H. philippinensis having two long wings and *H. resinosa* none. Flowering material, on the other hand, is very similar in both species but in *H. resinosa* the sepals are subequal in flower, while in H. philippinensis two sepals are clearly differentiated even in bud.

Collections examined:—

MALAY PENINSULA:

Pahang: C.F. 3602 a & b (Auth. spec. of B. pubescens Ridl.), 15687, & 29671.

JOHORE: S'pore 28514.

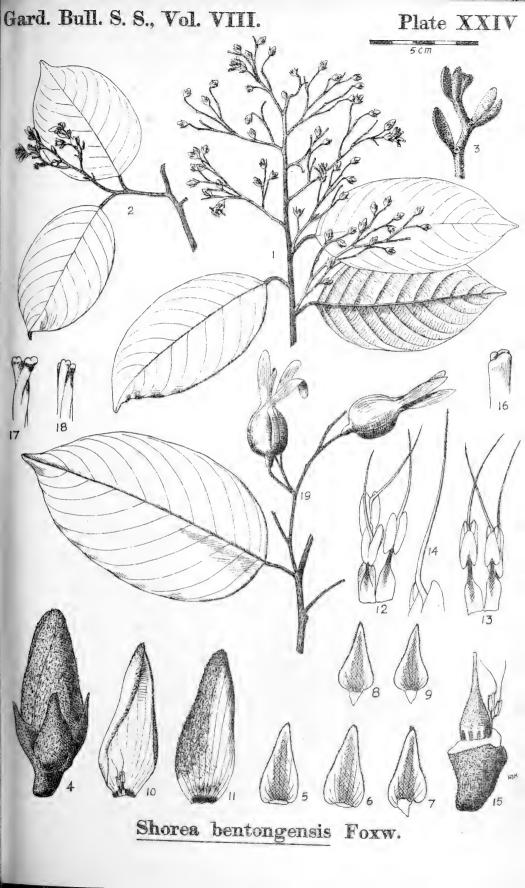
A small dipterocarp with smooth bark and stiltroots has been collected several times, from the Kuantan and Rompin districts of Pahang, under the vernacular names of merawan mata kuching and boyan (said to be a Sakai name). In 1922 it was described as Balanocarpus pubescens but it is shown that the species is more correctly referable to the genus Hopea. The transfer is here made and a new specific name "resinosa"* is chosen because a Hopea pubescens already exists.

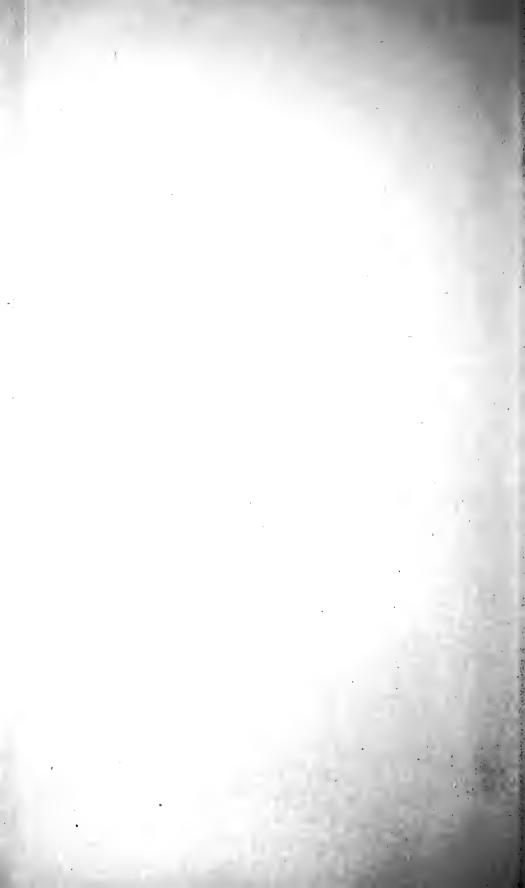
^{*} This name is descriptive of the peculiar resinous coating on the fruits.

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Shorea bentongensis Foxw., Mal. For. Rec. 10: 169 (1932) tab. XII: Shorea pahangensis Foxw., op. cit. 193, tab. XV, non Ridl. Ms. in Herb. Kew (= S. bractiolata Dyer). Plate XXIV.

Branchlets dark with a red tinge, tawny to ferruginous tomentose towards the ends. Leaves oval or ovate to elliptical, acuminate at the apex (acumen sometimes exceeding 1.0 cm. long), rounded at the base, from about 8.0 cm \times 3.7 cm. to 16.0 cm. imes 8.5 cm., glabrous except on the midrib above, minutely lepidote and sparsely stellate-hairy on the nerves beneath, drying light brown or yellow-green on both surfaces; midrib depressed and tomentose above, strongly elevate striate puberulous beneath; main nerves 11 to 16 pairs, inconspicuous above, prominent and puberulous beneath; nervules joining the main nerves in numerous more or less parallel lines, obscure above, prominent on the lower surface; petioles 0.8-1.3 cm., rugulose, channeled, dark, tomentose when young, later puberulous; stipules caducous, ovate to linear-oblong, subfalcate, 8.0 mm. × 4.0 mm. to 10.0 mm. \times 3.0 mm., 3 to 5-nerved, pubescent (sapling specimens only seen); buds small, flattened, ferruginous tomentose. Panicles mainly axillary towards the ends of the branchlets, subtended by leaves or caducous bracts, usually solitary, up to 8.0 cm. long, striate, tomentose when young, later pale puberulous; main axis of panicle alternately branched; branchlets at irregular intervals, solitary or in pairs, simple or bifurcate, usually 2 to 3flowered, subtended by caducous bracteoles. Flowers each subtended by a caducous bracteole or paired bracteoles, ovate in bud, about 8.0 mm. long (including the pedicel); pedicel 1.0-2.0 mm. long, pale tomentose. Sepals pale tomentose outside and, on the upper portion, inside; three outer ovate-oblong, obtuse or acute; two inner ovate-acuminate, thin at the edges. Petals ovate-oblong, pale tomentose outside (except for a narrow portion along one edge), pale yellow. Stamens normally 15 (15 to 20, Foxworthy), pairs alternating with single stamens; anthers oblong or ovate-oblong, posterior cells slightly smaller than the anterior; filaments 1 to 2 times as long as the anthers, broad and flattened below, narrowing gradually to the filamentous upper portion; appendage to connective 2 to 3 times as long as the anther, filiform, minutely setose in upper third (only visible under high magnifications). Ovary ovate-conical, tapering gradually into the style, minutely tomentose; style as long as the ovary, the upper half glabrous; stigma minute, obscurely (usually 3-) lobed. Fruit (immature specimens only seen)—a nut with 5 rudimentary wings; stalk thick, about 4.0 mm. long, with a









Shorea inaequilateralis Sym.

few stellate hairs; bases of calyx lobes forming an ovate-orbicular covering around the nut, woody, glabrescent or sparsely puberulous; three wings linear, acute or obtuse, up to $3.5~\rm cm. \times 1.0~\rm cm.$, about 7-nerved, puberulous when young (material inadequate for further description).

Shorea bentongensis was first collected in the Bentong district of Pahang in 1919 and described by Foxworthy in 1932. At that time the only flowering specimens available were C.F. 5875 (cited by Foxworthy under S. globifera) and C.F. 15774 upon which Foxworthy based his Shorea pahangensis. This latter specimen bears immature inflorescences and does indeed, at first glance, appear very different from the type of S. bentongensis. Careful study, however, with the added assistance of a recent excellent flowering collection of the species, makes it quite clear that S. bentongensis Foxw. and S. pahangensis Foxw. are conspecific.

The systematic position of this species presents no difficulties—it is a typical member of the section *Anthoshorea*.

Collections examined:-

MALAY PENINSULA:

Pahang: C.F. 3937, 15632, 15774 (Type of S. pahangensis Foxw.), 17275, 26215, 26505 (Type of S. bentongensis Foxw.), & 28052.

SELANGOR: C.F. 27898 & 29801.

JOHORE: C.F. 5875.

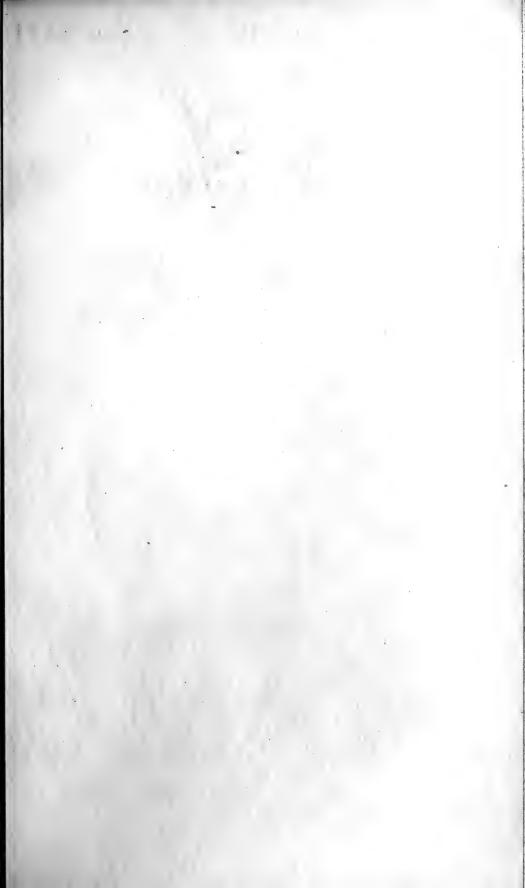
Shorea bentongensis is known to forest officers in Pahang West as meranti mengkai. It is shown that a specimen described in Mal. For. Rec. 10 as Shorea pahangensis is not specifically distinct and the two species are united, the name Shorea bentongensis being preserved.

Shorea inæquilateralis Symington, sp. nov.: "semayor", Durant, Rep. For. Brunei pp. 37 & 42 (1933). Plate XXV.

Species floribus S. palembanicae Miq. affinis, sed foliis inæquilateralibus breve-petiolatis, stipulis bracteisque panicularum persistentibus, nuce longe-alato rostellato differt.

Branchlets ridged, tawny tomentose (dark purple-red underneath the tomentum). Leaves inæquilateral, oval to elliptic-oblong, long-acuminate at the apex (acumen up to 2.0 cm. long), cordate at the base, or rounded on one side, and cordate on the other, about 8.0 cm. \times 3.5 cm. to 14.0 cm. \times 6.0 cm., sparsely stellate-hairy (except midrib) above, sparsely stellate-hairy to densely silvery tomentose

beneath, drying usually to a dull purple-red above, stramineous to silvery beneath; midrib slightly depressed and densely tomentose above, elevate stellate-tomentose or sparsely stellate-hairy and striate beneath; main nerves about 11 to 13 pairs, inconspicuous above, elevate and hairy or tomentose beneath; intermediary nerves occasionally present; nervules joining the main nerves in more or less parallel lines, inconspicuous above, more prominent beneath; petioles 0.7-1.0 cm. long, thick, rugose, tomentose; stipules oblong-lanceolate, subcymbiform, about 2.0 cm. long, puberulous, persistent towards the ends of the branchlets. Panicles axillary (or subaxillary) and terminal, solitary, when axillary about as long as the leaves, tawny tomentose at the base, hairy towards the ends, usually consisting of 2 to 4 regularly alternating branchlets and terminating in an apparently sympodial arrangement; peduncles about 2.0-4.0 cm. long, with two subopposite, cymbiform, bifid, persistent bracts about the middle; branchlets subtended by persistent stipular bracts about 1.0 cm. long, each bearing 2 to 3 secund flowers: bracteoles subtending the flowers caducous (not seen). Flowers about 0.8 cm. apart, ovatelanceolate in bud, 1.5-2.0 cm. long (including the pedicel); pedicel 2.0 mm. long, pale tomentose. Sepals tomentose outside and hairy on the upper portions inside; three outer oblong-lanceolate, acute; two inner ovate-acuminate, slightly shorter. Petals linear-oblong, rounded at the apex, silvery tomentose outside (on the portion exposed in bud), "white striped with red" (native collector). Stamens 15, of two different lengths, pairs alternating with single stamens; filaments broad at the base, filamentous above, 1 to 2 times as long as the anthers; anthers oblong, posterior cells smaller than the anterior; appendage to connective filiform, slightly longer than the filament and anther, minutely setose towards the end (only visible under high magnifications). Ovary ovate-conical, tapering gradually into the style, villous (except for the glabrous basal portion); style cylindrical, about twice as long as the ovary, pilose on the lower half, glabrous above; stigma minute; apparently simple. Fruit—a 5-winged nut; stalk about 4.0 mm. long, sparsely hairy; bases of accrescent calvx lobes thickened and woody, embracing one half of the nut, sparsely hairy; three outer wings subequal, linear-spathulate, acute or rounded at the apex, narrowed at the base, about 11.0 cm. \times 1.5 cm. to 14.0 cm. \times 2.0 cm., 9 to 11-nerved with conspicuous transverse nervules, sparsely stellate-puberulous on both surfaces, red-brown when mature; two inner wings subequal, about two thirds as long as the outer wings, acute at the apex, about 0.4-1.0 cm. broad, about 8-nerved, texture as in large wings; nut ovate, rostellate, about 2.5

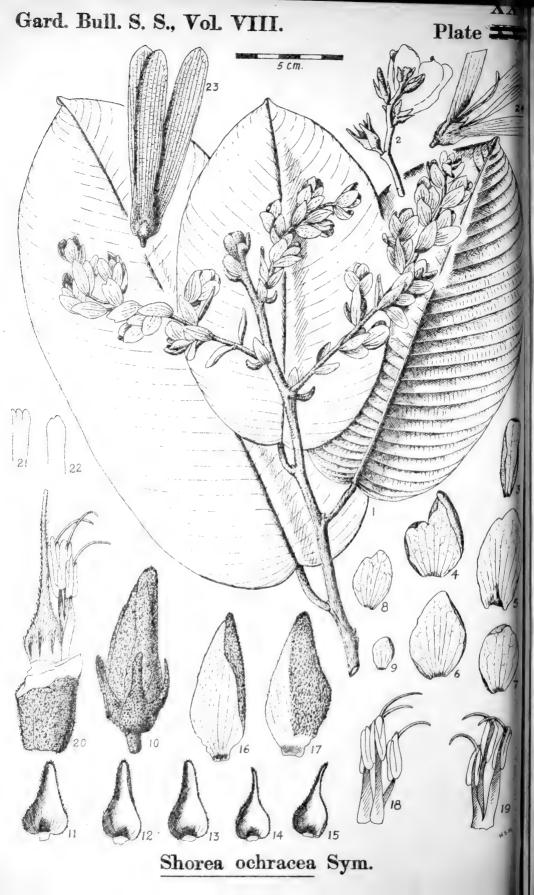


flattened, lentiginose, densely Branchletscoarse. cinereous stellate-tomentose when young; later becoming terete, glabrescent, dark or glaucescent. Leaves elliptical, elliptic-oblong, or elliptic-obovate, shortly (usually blunt) acuminate at the apex, rounded at the base, about 9.0 cm. \times 4.0 cm. to 15.0 cm. \times 7.0 cm., glabrous and usually drying to a dull light red-brown above, lentiginose and densely close stellate-tomentose (at first whitish but becoming darker) beneath: midrib depressed above, elevate and cinereous tomentose beneath; main nerves about 17 to 24 pairs, not elevate above (frequently inconspicuous), slightly elevate and more distinct beneath; 1 or sometimes 2 intermediary nerves (up to 1.5 cm. long) occur between the main nerves; nervules in numerous parallel lines joining the main nerves, invisible but indicated on the lower surface by rows of large stellate hairs; petioles 2.0-3.0 cm. long, rugose, cinereous stellate-tomentose; stipules caducous (not seen). Panicles axillary and terminal, solitary, usually shorter than the leaves; main branches flattened, texture as in young branchlets; ultimate branchlets about 4 to 10, about 1.0 cm. apart, regularly alternating, simple or bifurcate (sometimes from the base), about 1.0-3.0 cm. long, usually 3 to 4flowered, silvery tomentose. Flowers secund, about 0.8 cm. apart, subsessile, about 1.0 cm. long in mature bud. Sepals densely silvery tomentose outside and along the upper margin inside; three outer ovate-oblong, obtuse; two inner ovate-acute or acuminate, slightly shorter. Petals linearoblong, blunt minutely silvery tomentose outside with a dense hairy apical fringe, glabrous on the side covered in bud, yellow (native collector). Stamens 20 to 25, variable in length; filaments broad and flattened below, narrowing rather abruptly to the filamentous upper third; anthers oblong,* slightly broader at the base, usually longer than the filaments, posterior cells smaller than the anterior (similar to those of Anisoptera laevis Ridl.); appendage to connective—a short, curved awn (seen to be slightly pappilose under high magnifications). Ovary ovate-conical, tapering gradually into the style, glabrous at the base, villous above; style cylindrical, about one and a half times as long as the ovary, villous below, glabrous and often elliptical in crosssection in the upper half; stigma not enlarged, simple or minutely bifid. Fruit—a 5-winged nut;† stalk 1.0-2.0 mm. long, stellate-hairy; bases of accrescent calvx lobes thickened and woody, embracing rather more than one half of the nut, stellate-hairy; three outer calyx lobes linearspathulate, about 6.0 cm. \times 1.0 cm. to 7.5 cm. \times 1.3 cm.,

† The fruits described are possibly not quite mature.

^{*} The abnormal stamen found in one flower, and figured in Plate XXII No. 14, is of interest.





about 10-nerved, with conspicuous obliquely transverse nervules, puberulous and with a few large stellate hairs at the base, dull light brown when mature; two inner lobes linear, 2.0 cm. \times 0.3 cm. to 4.0 cm. \times 0.5 cm., of similar texture to the outer wings; nut globulose, rostellate, about 1.0 cm. long, pale tomentose; rostellum 2.0-3.0 mm. long, villous (frequently broken).

This species is most readily referable to the section *Anthoshorea* but is is quite distinct from any member of that group that I have examined. Sterile material is readily recognizable on account of the characteristic pale stellatelepidote tomentum on the under surfaces of the leaves and

on the young twigs.

Collections examined:—

SARAWAK: For. Dept. Sar. 154 (TYPE of fruit of S. albida Sym.); B. J. C. Spurway; Bukit Lima F.R., Compt. 1, freshwater swamp; 3rd May 1932; fruit. Field notes—vern. name, "meraka paya", tall tree, 140 feet high, 9 feet 10 in. girth.

For. Dept. Sar. 174. C.F. 30353 (Type of flower of S. albida Sym.); Zainal; Kuala Belait, swamp; 23rd 1934; flower. Field notes-vern. "seringawan", tree 130 feet high, and 60 in. girth, flower yellow, plants blackish, bark used for making walls of houses.

C.F. 28680, 28699, 28700 ,30565, & 30588.

Specimens of a tree, called seringawan in Brunei, were first collected in Sarawak in May 1932 by Mr. Spurway. Subsequently Messrs. Durant and Smith have made several collections and drawn attention to the comparative abundance of the species in the coastal swamp forests of Brunei. With a view to the possible importance of the timber for export, pilot tests have been carried out in our laboratories at Sentul, the timber being favourably reported upon as a "good-grade red meranti". It is here described and named Shorea albida.

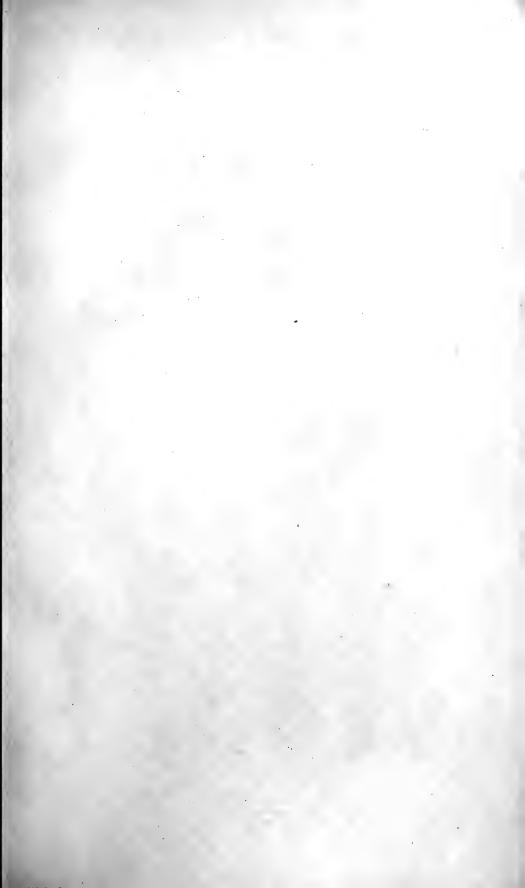
Shorea ochracea Symington, sp. nov.; non S. ochracea Dyer, Ms. in Herb. Kew (= S. inappendiculata Burck): "majau", Durant, Rep. For. Brunei p. 43 (1933). Plate XXVII.

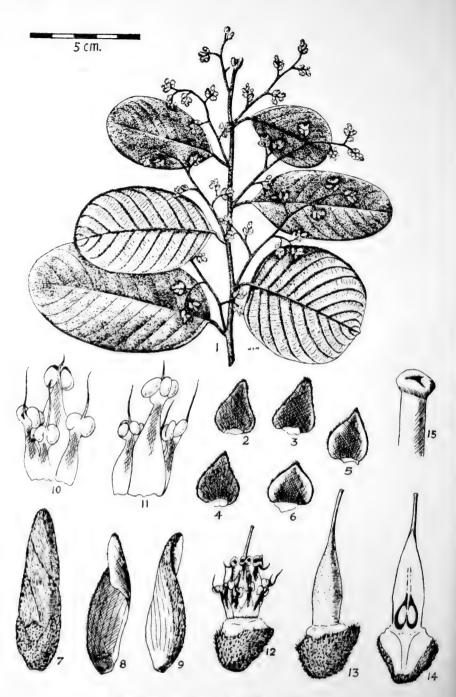
Species nova sectioni Anthoshoreae affinis, sed omnibus speciebus ramulis crassis ferrugineo-lepidotis, foliis magnis ochraceo-lepidotis, bracteis bracteolisque magnis persistentibus. fructu alis subauriculatis facile distinguenda.

Branchlets thick, terete, ferruginous furfuraceous when young, later cinereous. Leaves oblong and elliptic-oblong. shortly blunt-acuminate at the apex, cordate at the base,

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averaging about 21.0 cm. × 12.0 cm, but may be considerably larger, coriaceous, glabrous and pale yellow-or brownglaucescent above, bright ochraceous to ferruginous lepidote beneath; midrib depressed above, elevate, striate, lepidote, and thick at the base beneath; main nerves about 30 to 36 pairs, inconspicuous above, elevate beneath; nervules joining the main nerves in numerous parallel lines, obscure above, subobscure or distinct beneath; petioles 2.0-3.0 cm. long, thick, scabrous, sparsely ochraceous-ferruginous lepidote; stipules oblong, subfalcate, about 1.5 cm. × 0.6 cm., ferruginous lepidote, caducous. Panicles terminal and axillary towards the ends of the branchlets, solitary, 6.0-14.0 cm. long, ferruginous-ochraceous lepidote to stellate-tomentose; peduncles 2.0-3.0 cm. long, bracteate; branchlets 5 to 8, regularly alternating, 1.0-2.0 cm. apart, racemose, each subtended by large, papyraceous, stellate-hairy, persistent, foliolar (sometimes absent) and stipular bracts. Flowers about 6 per branchlet, each subtended and embraced by large papyraceous, stellate-hairy, stipular bracteoles; mature bud about 14.0 mm. long (including the pedicel); pedicel 1.5 mm. long, stellate-tomentose. Sepals dense pale stellate-tomentose outside and puberulous towards the apex inside; three ovate-lanceolate, rounded at the apex, cordate at the base; two ovate-acuminate, slightly shorter, thin at the edges. Petals elliptice-ovate, tomentose outside on the portion exposed in bud, sparsely puberulous inside and on the remaining portion outside. Stamens 15, of three lengths, pairs alternating with single stamens; filaments linear, flattened, slightly narrowed above; anthers oblong, about two thirds to as long as the filaments, posterior cells smaller than the anterior; appendage to connective awlshaped, recurved, about as long as the anther. Ovary ovateconical, tapering gradually to the style, silvery pilose (except at the base); style cylindrical, longer than the ovary, silvery hairy (except for a short glabrous apical portion); stigma minute, obscurely, minutely (sometimes 3-) notched. Fruit—a 5-winged nut: stalk 4.0-5.0 mm. long, stellate-hairy; calyx lobes free almost to the base, but appressed to, and obscuring, the lower half of the nut; three outer calyx lobes linear-oblong, rounded at the apex, subauriculate at the base, about 8.0 cm. × 1.4 cm., puberulous on the free portions, densely ochraceous-pilose outside at the base, 9 to 11-nerved; two inner lobes broad and embracing the lower portion of the nut at the base, narrow and long-acuminate in the free portion usually unequal, the longest up to about 3.0 cm., few-nerved, similar to the large lobes in texture; nut ovate-conical, rostellate, about 1.3 cm. long, densely ochraceous-pilose; rostellum about 0.5 cm. long, hairy except at the apex (frequently broken off).





Shorea scabrida Sym.

Shorea ochracea has many of the characters typical of the section Anthoshorea and I have little hesitation in referring it to that group. The large leaves, the thick branchlets, the ferruginous-ochraceous scurfy tomentum, the large, persistent bracts and bracteoles of the inflorescence, and the rather unusual subauriculate wings on the fruit, make this a very distinct and easily-recognizable species.

Collections examined:-

SARAWAK: For. Dept. Sar. 167 (TYPE of flower of S. ochracea Sym.); B. J. C. Spurway; Mirirai, Balleh, hill forest; 27th Nov. 1933; flower. Field note—vern. name, "ruruk", tree 90 feet high, 5 feet girth.

BRUNEI: C.F. 30363 (TYPE of fruit of S. ochracea Sym.);
Abang Bujang; Sungei Keduan, hill side; 25th Nov.
1934; fruit. Field note—vern. name, "lon (Sarawak name)", tree 140 feet high, 156 in. girth, flower yellowish (probably this refers to the bracts. C.F.S.), fruit small, 3-winged.

C.F. 28712, 30612, & 39603.

BRITISH NORTH BORNEO: For. Dept. No. 67 (Villamil).

This species was first collected by Vallamil in British North Borneo in 1915. Additional collections (including flower and fruit) from Sarawak and Brunei have made it possible to describe the species. The name *Shorea ochracea* is here given to it. The timber appears to belong to our "white meranti" class. As yet we know little concerning the abundance of the tree but it is evidently quite widely distributed on low hills or undulating land. The vernacular names lon, majau, and raruk have been recorded.

Shorea scabrida Symington, sp. nov.

Species S. Teysmannianae Dyer, S. leprosulae Miq., S. pavifoliae Dyer, etc. affinis, foliis parvis, obovatis, infra scabridis distincta.

Branchlets ferruginous stellate-tomentose towards the tips, later becoming glabrescent, lenticellate, black, with decurrent-elevate lines. Leaves usually obovate, but may be oval to elliptic-oblong, rounded, retuse, or rarely blunt-acuminate, at the apex, acute to rounded at base, averaging about 6.0 cm. \times 3.5 cm., glabrous (except on ridrib and main nerves) and dull purple-brown to black above, shining light to dark brown and stellate-hairy on the nerves beneath; midrib depressed and tomentose above, elevate, striate, and furnished with coarse, tufted, stellate hairs beneath; main nerves about 9 to 12 pairs, slightly depressed and tomentose towards the midrib above, elevate and coarsely stellate-hairy

beneath; nervules joining the main nerves in wavy subparallel lines, fine (sometimes obscure) on both surfaces, with occasional stellate hairs on the lower surface; petioles 0.7-1.5 cm. long, ferruginous stellate-hairy to tomentose; stipules oblong, about 5.0 mm. × 2.5 mm., ferruginous stellate-tomentose outside, caducous. Panicles axillary and terminal, solitary, up to 8.0 cm. long, (usually shorter), occasionally compound but usually with about 8 regularly alternating branchlets, coarsely ferruginous stellate-hairy; peduncles short; branchlets about 0.7 cm. apart, simple or bifurcate, about 1.0 cm. long, furnished with 3 to 7 closely set distichous flowers. Flowers oblong-lanceolate, up to 8.0 mm. long in bud, sessile. Sepals densely tawny stellatetomentose outside, glabrous inside; three ovate-obtuse; two broadly ovate, acute, slightly shorter than the others, thin at the edges. Petals oblique-oblong, fimbricate at the apex, pale villous on the portion exposed in bud, "white" (For. Dept. Sar. 171). Stamens 15, of three pairs alternating with single stamens; filaments broad, flattened, subgibbous at the base, gradually narrowing above, when mature 4 to 10 times as long as the anthers; anthers globular, cells subequal, appendage to connective as long as the anther (large inner row), 2 to 3 times as long (shorter outer rows), at first erect, latter curved and deflexed. Ovary and stylopodium elongateconical, glabrous on the lower portion, finely tomentose above; style cylindrical, about half as long as the ovary with stylopodium, glabrous (except where it joins the stylopodium); stigma slightly enlarged, obscurely 3-lobed. Fruit unknown.

It is not possible to refer this species to any of the sections of the genus Shorea as they are at present defined. The species to which Shorea scabrida is closely allied have usually been referred to the sections Pinanga and Mutica. Among these species are Shorea leprosula Miq., S. Teysmanniana Dyer, S. parvifolia Dyer, S. lepidota (Korth.) Bl., S. platycarpa Heim, S. rugosa Heim., and many others. Collectively these species produce most of the red timber known in the Malay Peninsula as "red meranti". The most distinctive diagnostic character of S. scabrida is the small, obovate leaves, which, being sparsely furnished with large, stellate hairs on the veins on the lower surface, are rough to the touch yet comparatively glabrous in appearance.

Collections examined:-

SARAWAK: Haviland 2227 (Kew & Mus. Kuching), & s.n. 25th March 1893 (Mus. Kuching); For. Dept. Sar. 171 (Type of flower of S. scabrida Sym.) Md. Yusop;

Bukit Lima Forest Reserve, swamp; 7th Feb. 1935; flower. Field note—vern. name, perawan lop, small tree 72 feet high, 4 feet girth, flower white.

Brunei: C.F. 30513, 30552, & 30619.

Shorea scabrida, which is here described, was first collected by Haviland in 1892. Several additional collections have recently been made by forest officers in Sarawak and Brunei, where the tree appears to occur on coastal hills. Mr. Smith reports that the bark is like meranti tembaga (Shorea leprosula). These species are, actually, closely related botanically, and one would expect to find that, like Shorea leprosula, Shorea scabrida produces timber of the "red meranti" class. The only vernacular name so far recorded for S. scabrida is meraka telor (Kedayan).

Explanation of Plates

- Plate XVI. Shorea guiso (Blco.) Bl. 1, flowering twig. 2, twig with immature fruits. 3, twig with mature fruit. 4, mature flower bud. 5, expanding flower. 6 & 7, petal from mature flower. 8 to 12, sepals. 13, ovary—sepals & petals removed. 14, style & stigma. 15, longitudinal section through ovary. 16—24, stamens. (Drawings of 1 & flower parts based mainly on C.F. 17788; 2 on C.F. 8334; and 3 on C.F. 9508). Scale applies to 1, 2, & 3 only.
- Plate XVII. Shorea ochrophloia E. J. S. ex Sym. 1, sterile twig. 2, flowering twig. 3, ripe fruit. 4, flower bud. 5, expanded flower. 6 & 7, petal from expanded flower. 8-12, sepals. 13, ovary-sepals & petals removed. 14, longitudinal section through ovary. 15 to 19, stamens. (1 & 3 based on C.F. 29016; 2 & flower parts on C.F. 27482). Scale applies to 1, 2, & 3 only.
- Plate XVIII. Shorea collina Ridl. 1, flowering twig. 2, leaf showing cordate base. 3, 4, & 5, mature fruits. 6, expanded flower. 7 & 8, petal from expanded flower. 9, 10, & 11, large sepals. 12 & 13, smaller sepals. 14, ovary. 15, section through ovary. 16, stigma. 17, 18, 19, 20, & 21, stamens. (Flower drawings based on C.F. 319; fruit on C.F. 9509 & 29336). Scale applies to 1-5 only.
- Plate XIX. Shorea Foxworthyi Sym. 1, flowering twig. 2, ripe fruit. 3, mature flower. 4 & 5, inner sepals. 6, 7 & 8, outer sepals. 9, petal from mature flower (posterior). 10, petal (anterior). 11, ovary—sepals & petals removed. 12, 13, 14, & 15, mature stamens. 16, long. section through ovary. 17, end of style & stigma. 18, cross—section of ovary. (Flower drawings based on C.F. 30301; fruit on C.F. 28804). Scale applies to 1 & 2 only.
- Plate XX. Hopea Helferi (Dyer) Brandis. 1, flowering twig. 2, cordate leaf from sapling. 3, mature fruits. 4 & 5, immature fruits. 6, expanded flower. 7 & 8, flower buds. 9 & 10, thick outer sepals. 11, 12, & 13, inner sepals. 14 & 15, petal. 16, ovary. 17, long—itudinal section through ovary. 18 & 19, stamens. (1 & drawings of flower parts based on Maymyo 7605 (F. No. 1929); 5 on C.F. 21462). Scale applies to 1-5 only.

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Plate XXII. Hopea apiculata Sym. 1, 2, & 3, mature fruits. 4, 5, 6, & 7, embryo removed from pericarp. 8, pericarp split on germination. 9, embryo just before germination. 10, embryo—germination commenced. 11, placenta. 12—18; stages in germination; 12 & 13=3 days after sowing, 14=4 days, 15=9 days, 16 & 17=17 days, and 18=81 days. (Drawings authenticated by C.F. 39106). Scale

applies to all except 18 which is × ½.

Plate XXIII. Hopea resinosa Sym. 1 & 2, flowering twigs. 3, flower. 4, flower bud. 5 & 6, petals from mature bud. 7, 8, & 9, outer sepals. 10 & 11, inner sepals. 12, ovary and stamens. 13, ovary sepals. 10 & 11, inner sepals. 12, ovary and stamens. 13, ovary—perianth and stamens removed. 14, stigma seen from above. 15 & 16, stamens. 17, mature fruit with resinous coating. 18, mature fruit—resinous coating removed. 19, 18 seen from above. 20, 18 with accrescent sepals removed. 21, pericarp dissected to show mode of splitting on germination. 22, 24, 25, & 26, embryo. 23, placenta. (Drawings of flowering twigs and flower parts based on C.F. 17193; fruit & embryo on C.F. 3602). Scale applies to 1

on C.F. 17193; fruit & embryo on C.F. 3602). Scale applies to 12, & 17 only.

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bud. 10, 11, & 12, outer sepals. 13 & 14, inner sepals. 15 & 16, petal. 17, 18, & 19, stamens. 20, tip of appendage highly magnified. 21, ovary. 22, immature fruit. 23, mature fruit. (Drawings of twig & flower parts based on C.F. 30351; 22 on C.F. 30358; 23 on For. Dept. Sar. 153). Scale applies to 1, 22, & 23 only.

Plate XXVI. Shorea albida Sym. 1, flowering twig. 2, flower bud. 3, 4, & 5, outer sepals. 6 & 7, inner sepals. 8 & 9, petal. 10, 11, 12, & 13, stamens. 14, abnormal stamen. 15, appendage to connective highly magnified. 16, ovary. 17, stigma. (Drawing of flowering twig and flower parts based on C.F. 30353; fruits on For.

Dept. Sar. 154). Scale applies to 1, 18, & 19 only.

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23. & 24 only.

Plate XXVIII. Shorea scabrida Sym. 1, flowering twig. 2, 3, & 4, outer sepals. 5, & 6, inner sepals. 7, flower bud. 8 & 9, petal. 10 & 11, stamens from young bud. 12, mature bud—sepals and petals removed. 13, ovary. 14, section through ovary. 15, stigma. (Drawings based on For. Dept. Sar. 171). Scale applies to 1

only.

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THE TREE-FERNS OF THE MALAY PENINSULA

By R. E. HOLTTUM

The tree-ferns of the Malay Peninsula all belong to the family Cyatheaceæ. Dicksoniaceæ is represented only by Cibotium, which, with its creeping stem, can hardly be called a tree-fern. *Dicksonia Blumei* occurs in Borneo and in Sumatra, but has not so far been found in the Peninsula. It is hardly likely to be found now, as fairly intensive collecting has been done in localities where it might be expected to occur. It is only during the past few years, however, that so widely distributed and conspicuous a fern as *Osmunda javanica* has been found in the Peninsula, so it is just possible we may still find *Dicksonia Blumei*, which can be as large and handsome as our largest Cyatheas.

In this paper I follow Copeland in including Alsophila and Hemitelia in Cyathea. It is quite clear that no natural separation of this group of ferns can be made on indusial characters, and to decide what other characters might be used as a basis of division would require the study of the genus Cyathea as a whole, a task which I cannot attempt. Of the genus Cyathea in the broad sense, sixteen species are here described as occurring in the Peninsula, and also a new variety of one of them (C. latebrosa). Of these species, one is described as new (C. excavata), and one (C. ampla) has not previously been reported. One (C. obtusata) is rather a dubious species, not adequately known, and two others (C. obscura and C. Burbidgei) ought possibly to be reduced to varieties. The status of all the species has been critically considered, and type specimens of almost all have been examined. Special attention has been given to C. glabra, a very variable species. The new combination Cyathea gigantea is made.

A comparative survey of all species of Cyathea in the Malayan region is certainly needed, but I cannot at present undertake that task; the number of species is very large, and for an effective survey the types of all would have to Many of the published descriptions are such be examined. that one cannot be reasonably sure of the identity of specimens from them; and indeed the best descriptions are hardly adequate when one is dealing with so great a number of species, which yet have all a very similar general aspect, and where considerable variation in one character or another may occur. One can find variable characters only by examining a number of specimens of the same species. I have therefore come to the conclusion that it is better in the first place to deal as adequately as possible with the Peninsula species, of which I have a considerable number

of specimens for examination, and almost all of which I know in the field. A careful description of these may be helpful to others working on this group; and for local use the collecting of the available information into one paper will be of value.

The large number of species in this family of ferns, which there is every reason to regard as relatively primitive, is very remarkable, and a study of their individual distribution would be instructive. Unfortunately, before this can be effectively undertaken, a full systematic survey (as above indicated) is necessary. It is fairly clear that a number of the species are of restricted distribution, and it is probable that most of these are confined to mountains. while the species that will tolerate lowland conditions are of wider distribution. The great wealth of species, and the variation which occurs in the widely distributed species, are indications that the family is still a vigorous one. An analysis of the family from a phylogenetic standpoint has never been attempted, and the great majority of the species have never been examined further than the barest external features such as are usually found in systematic descrip-How much variation in soral development may occur is not known; a casual inspection suggests that there is not much, but a thorough examination might reveal some interesting points hitherto overlooked. My own impression is that the scales on the stipe-bases are likely to be the best single character for discrimination of phyletic relationships within the group, venation probably coming next.

Sixteen species probably represent less than 10% of the number of Cyatheas described as occurring in the Malayan region; and even allowing for a fair proportion of the latter being reduced, we still have a poor representation of the family as compared with Sumatra. This is no doubt largely due to the lack of high mountains in the Peninsula. In Sumatra there is a large area of good forest between 6,000 and 8,000 feet above sea level, a forest exceedingly rich in ferns of all kinds, whereas there is very little high forest in the Peninsula at a similar altitude. There may yet be a few more species of tree ferns still to be found in the Peninsula, but I think the number will not be greatly increased.

Tree ferns are not numerous and conspicuous objects in the landscape except in rather open places on the hills, especially near streams; and here the gregarious and conspicuous species is *C. contaminans*, which is the largest of all our tree ferns, with very massive erect trunks and large crowns of fronds. All the other species are smaller in stature. The other really common species is *C. latebrosa*,

which is quite abundant in low country and mountains alike, at least up to 4,000 feet. It has a more slender trunk than C. contaminans and does not usually grow in quite such exposed places. It is often found near streams in fairly open forest or in secondary growth, but not often in large numbers, so that it never gives massed effects like C. contaminans. C. squamulata is not uncommon in rather more moist and shady lowland forest; also C. brunonis, which is so small as hardly to be called a tree fern. Species which only occur in mountain forest are C. recommutata, C. Kingii, C. excavata and C. obscura. C. glabra is found both in lowland and mountain forest, and varies much in degree of incision of the pinnules; perhaps altitude and other environmental factors may be partly responsible for this varition. *C. gigantea* is only found in the extreme north of the Peninsula, and is there at the southern limit of its distribution. C. tripinnata, found on Pulau Tioman, but not yet on the mainland of the Peninsula, was first found in Luzon, and then North Borneo; Pulau Tioman is perhaps its most westerly position. On Mt. Kinabalu it is frequent and very massive in growth at about 5,000 feet altitude, so that it might quite possibly find a suitable home in the Peninsula.

It is not possible to give complete information about the distribution beyond the Peninsula of the species here concerned, as the published data are inadequate. The following summary is of a general nature only.

C. latebrosa is widely distributed from India

throughout the Malayan region.

C. squamulata, C. contaminans and C. glabra have a wide distribution within the Malayan region.

- C. Brunonis and C. recommutata are known to occur in Borneo and Sumatra.
- C. obscura and C. Kingii are known to occur in Sumatra.
- C. alternans, C. Burbidgei, C. ampla and C. polypoda are known to occur in Borneo.
- C. tripinnata has been found in Luzon, British North Borneo and Pulau Tioman.
- C. glabra is distributed from the Himalayas southwards to Penang.
- C. obtusata and C. excavata are only known to occur in the Peninsula.

Of the last species, *C. obtusata* is apparently closely allied to *C. latebrosa*, but is incompletely known. *C. excavata* appears to be a very distinct species, and has so far been found only in the neighbourhood of Cameron's Highlands, on the Main Range.

The distinction of the commoner Peninsula species of Cyathea is not difficult. One has only to look at the base of the stipe to be able to recognise at a glance C. contaminans, C. latebrosa and C. squamulata (including its near allies C. obscura and C. Burbidgei). The presence or absence of thorns, the characters of the scales and the colour of the stipes are indeed always important in distinguishing species of Cyathea, and without the base of the stipe it is often difficult to be sure of a species. abundance and character of scales and hairs on the rachises. costæ and costules are also important, and a rather high magnification, beyond the scope of the pocket lens, is necessary to distinguish clearly the smallest scales. regards the lamina, characters of the base and apex may be useful, but for most purposes I find that the only safe method of comparison is between the largest pinnæ of full-In some species, particularly C. glabra among size fronds. those here described, the variation in cutting of the pinnules is considerable; in others, other characters may be variable, such as the indusium in C. Brunonis. Venation, texture, colour and characters of the paraphyses and indusium (if present) are also important.

In most cases, I have examined considerable numbers of specimens of each species, nearly all from within the Peninsula, but in some cases from a wider area. I have been led on the whole to a rather broad interpretation of the species, on account of the obviously considerable variation in some cases, notably in *C. glabra* and *C. squamulata*. If one could choose a few isolated specimens, it would be easy to make several species from each of these, but having regard to the whole range of variation, I cannot see where to draw lines of division. I am sure that environmental conditions have a good deal to do with characters of size and texture. I may add that I have myself examined nearly all the species concerned in the field, and some of them in cultivation.

Cyathea plants do not usually bear sporangia until they have reached their fully adult size of frond, but there are exceptions to this rule. It may occasionally happen that small simply pinnate fronds of young plants are fertile. I have seen this condition in *C. squamulata* and *C. obscura*. *C. parvifolia* Holttum, described before I realised that such a thing could occur, is an immature form, probably of *C. squamulata*. I believe that *C. bipinnatifida* Copel. (Phil. Journ. Sci. 56: 97. 1935) is a similar case.

The limitation of certain species to mountains may be due to the specialised conditions necessary for the development of their gametophytes. I have now in cultivation in Singapore, growing reasonably well, C. contaminans, C.

recommutata and C. tripinnata, none of which have ever been found in lowland localities, at least in the south of the Peninsula; it is therefore not because they cannot exist in the lowlands. The conditions for the germination of the spores and growth of prothallia are evidently more specialised than those necessary for the growth of the mature sporophytes. Similarly, Platycerium grande, not uncommon in the extreme north of the Peninsula, grows quite well in the Singapore Botanic Gardens but, though it must produce countless spores, no young plants of it have ever been found; the reason is probably climatic. Other species will grow well here when introduced as mature plants, but never have spores; among these is Polypodium ellipticum.

The descriptions in this paper are taken from specimens in the Singapore Herbarium, except where otherwise indicated. An attempt has been made to make them as comprehensive as possible.

The Peninsula specimens which I have examined are listed at the end of each description. Recent collections made by the staff of the Singapore Botanic Gardens are numbered in a series of Singapore Field Numbers; these are cited as SFN with the collector's name in brackets afterwards. Similarly, the Forest Department's collections are cited Forest, with the collector's name in brackets. Ridley had his own series of numbers, and so had the Federated Malay States Museums. For reference to other Collectors and localities, the reader is referred to Burkill's paper in this Bulletin, Vol. IV pp. 114–202 (1927).

Key to the Species described in this Paper

This key is intended primarily for the assistance of field workers, and the characters chiefly used in separating the main divisions of the key are those of the stipe-base; these are easily recognised in the field, and are also very distinctive. A key based chiefly or only on pinnæ would be much less certain of application.

The field worker is advised to look for and collect fronds which have just reached maturity, as old fronds often lose their scales. In some species (e.g. *C. excavata*) the scales fall very early, and it is necessary to look for them on unexpanded fronds. When the scales fall, they usually leave small raised bases, which give a roughness to the base of the stipe; in some species these rough bases are prolonged into short thorns. The important characters

of the scales can easily be distinguished with a pocket lens: those of the *C. squamulata* group have very short stiff hairs or setæ regularly arranged along their edges; the scales of *C. latebrosa* and others have smooth edges; and the scales of the *C. glabra* group are dark with thin pale edges. The characters of the small scales on the costæ (pinnule midribs), costulæ and veins can only be seen when more highly magnified.

The inclusion of C. obtusata under the heading "base of stipe shortly thorny" is conjectural, but in view of its agreement with C. latebrosa in other respects, one may reasonably expect an agreement in stipe characters also.

reasonably expect an agreement in stipe	CH	aracters also.
Pinnæ simple, subentire	1.	C. Brunonis
Pinnæ pinnatifid, or pinnate at base only	2.	C. alternans
Pinnæ pinnate or bipinnate— Base of stipes strongly thorny, stipes glaucous (purple when old) Base of stipes shortly thorny, stipes not glaucous—	3.	C. contaminans
Pinnules pinnate over most of their length	4.	C. tripinnata
Sori with minute scale on inner side only		C. latebrosa r. indusiata
Sori with large scale on inner side, costæ with very few scales beneath	6.	C. obtusata
Base of stipes subglabrous; below them a V-shaped row of large depressions in caudex	7.	C. excavata
of scales with dark setæ— Secondary rachises and costæ scaly but not hairy beneath— Texture distinctly coriaceous, scales at base of stipe only Texture rather thin, scales throughout_stipe— Pinnæ to about 1.5 cm.	8.	C. polypoda
wide— Sori when mature distinct, not coalescing Sori when mature coalescing and filling	9.	C. squamulata
pinnules almost completely Pinnæ to 2.5 cm. wide		C. obscura C. ampla

Secondary rachises and costæ very 11. C. Burbidgei hairy beneath Base of stipes rather sparsely scaly, the scales very dark, with pale Base of stipes bearing a few small 13. C. recommutata Base of stipes without pinnæ-Lobes of fertile pinnæ much 14. C. Kingii narrower than sterile Lobes of fertile and sterile pinnæ similar-Pinnules distinctly stalked, veins 3-5 pairs ... C. glabra Pinnules sessile, veins 5-6 16. C. gigantea pairs

 Cyathea Brunonis Wall. Hook. Spec. Fil. 1: 15. 1844. Schizocaena Brunonis J. Sm. Hook. & Bauer Gen. Fil. t. II. 1838.

Stock usually short, occassionally 50 cm. or more high. Stipes rather dark, slightly roughened when scales have fallen, with numerous scales at the base; scales to about 3 cm. long by 3 mm. broad, medium brown, the edges with short oblique dark setæ. Fronds pinnate, the apical pinna usually like the others, and all pinnæ articulate to the rachis. Pinnae sessile or on stalks to about 4 mm. long (occasionally to 7 mm.), 12 to 28 cm. long and 2 to 4 cm. wide, the base rather unequally cuneate or truncate, the apex acuminate, the edges entire, toothed towards the apex, occasionally the edges somewhat lobed; the edges almost parallel for the greater part of their length, or converging gradually over half the length; veins in groups of 3 to 5, the basal one on the side towards the rachis often springing directly from the midrib of the pinna, occasionally a single simple vein about half-way between two groups; scales on lower surface of midribs of pinnæ, and occasionally also on veins, few, small, narrow, ciliate; sori in 2 or 3 irregular rows on each side of midribs of pinnæ, indusia thin, covering young sori, usually appearing cup-shaped in mature sori, sometimes forming only a narrow ring at the base of the sori; paraphyses dark, shorter than the sporangia.

TYPE: Penang, Wallich 179.

In Christensen's *Index Filicum* the species *C. Brunonis* is referred to *C. moluccana* R. Br. (an earlier name). I have not seen the type of the latter species, which came from the Moluccas. In view of the fact that there are a group of species of simply pinnate habit, it is quite likely that Peninsula and Molucca plants are different, and I prefer to use the name *C. Brunonis*, the type of which is from the Peninsula, pending further evidence of the status of *C. moluccana*.

I have examined the type of *C. Brunonis*, in the Kew Herbarium. The upper pinnæ are sessile, the lower stalked; the indusia are fully developed; there is a single vein between the groups; the apical pinna is like the rest.

Several closely allied species have been described from Borneo, but in view of the undoubtedly considerable variation of *C. Brunonis* in the Peninsula it appears probable that these species (except *C. capitata*, which is very distinct) will have to be reduced in number when fuller collections are available. Without examination of representative collections of ferns of this alliance over a wide area, it is not possible to say exactly what is the range of *C. Brunonis*.

PENANG: Wallich 179 (Type, at Kew). Bishop Hose, s.n. April 1879; Top of hill, Ridley 7036.

KELANTAN: Batu Panjang, S. Keteh, SFN 12091. (Md Nur).

PAHANG: Tahan River, Ridley s.n. 1891; Wray's Camp, G. Tahan, Ridley 16214; G. Tahan 3,300 feet Wray & Robinson 5379; Teku, G. Tahan, SFN 8038 (Haniff & Nur); near Kota Glanggi S.F.N. 22508 (Henderson); The Gap, 3,000 feet SFN 8826, 11399 (Holttum).

PERAK: near Taiping 1,000 feet Scortechini 239; Gopeng, King's Coll. 475; Larut 300-1,000 feet King's Coll. 4885; Bidor near Tapah Ridley s.n.; Maxwell's Hill 2,500 feet SFN 13217 (Burkill); Taiping hill 1,000 feet F.M.S. Mus. 10201 (Henderson), 600 feet F.M.S. Mus. 10098 (Henderson).

SELANGOR: Kuala Lumpur, Native Coll. 3540 (Ridley); Ginting Sempah F.M.S. Mus. 9547, 9548, 9562, 9793 (Hume); Rantau Panjang F.M.S. Mus. 7617, 7673 (Hume); Semenyih F.M.S. Mus. 7889 (Hume); Sungei Buloh F.R. Forest 13907, 14610 (Strugnell); Sungei Lalang, Kajang, Forest 22813 (Symington).

NEGRI SEMBILAN: Sungei Ujong, Hullett s.n. Aug. 1880; Bukit Kayu Arang, Alvins s.n. Jan. 1894; Perhentian Tinggi, Ridley s.n. Dec. 1898; G. Angsi 1,500 feet SFN 11535, 1,000 feet SFN 11519 (Md. Nur).

JOHORE: Woods, Batu Pahat, Ridley 11061; 7th mile from Kluang SFN 9263 (Holttum).

MALACCA: Cuming 378; Sungei Udang Reserve, Derry 92; Bukit Bruang, Ridley s.n. Apr. 1891; Jasin to Chabau, Ridley s.n. 1892; Bukit Toongull Ridley 4403.

2. Cyathea alternans (Wall.) Pr. Abh. Bohm. Ges. V. 5: 347. 1848. *Polypodium* Wall. Cat. (nomen).

Stipes dark, scaly at the base, the scales to 3 cm. long by 2 mm. wide, dark brown, the edges with short oblique Rachises dark to medium brown, almost glabrous below, appressed hairy above. Middle pinnae to about 40 by 9 cm., more often about 25 by 5 cm.; lowest pinnule (or a few pinnules) free, sessile, others with the lamina more and more broadly joined to the costa; distal part of pinnæ (almost the whole pinnæ of smallest fronds) lobed about 3/4, to costa, the segments or pinnules about 7 to 8 mm. wide, entire or the largest crenate or toothed towards the apex, slightly oblique, slightly or hardly falcate, the apex rounded or in the largest fronds sometimes acute, usually very close, sometimes slightly overlapping; veins in each lobe or pinnule about 10 pairs or more, forked or the basal ones often more copiously branched; on costæ and veins beneath are a few hairs and also narrow to ovate acuminate usually pale scales with setose edges; sori in a single row on each side of costæ, rather nearer costæ than edge, indusium a thin cup, sometimes reduced to a narrow ring at the base of the sorus; paraphyses numerous, hardly exceeding the sporangia.

Type: Wallich 329, Penang.

This is a fern of lowland forest, not known in the extreme south of the Peninsula, and apparently rather local in its occurrence. In some places, as on parts of Penang Hill, it is fairly abundant. I have never seen a plant with a trunk more than 1.50 m. high. The species also occurs in Borneo. A collection from Mt. Kinabalu (Clemens 29160) appears to be quite without indusium.

PENANG: Hullett s.n. Dec. 1881; Curtis 10139; Government Hill, Road to Penara Bukit, Curtis s.n. Oct. 1898, Ridley 7152; Penara Bukit, Ridley 7151; Penang Hill 2,000 feet SFN 19341 (Holttum).

PERAK: G. Bubu, Cantley s.n. Jan. 1885.

KELANTAN: Ulu Sungei Keteh SFN. 12269 (Md. Nur). SELANGOR: Kuala Lumpur Ridley 10173; Petaling 10 mile, Ridley s.n. June 1889; Ginting Sempah F.M.S. Mus. 9635 (Hume).

NEGRI SEMBILAN: G. Angsi 2,600 feet SFN 11635 (Md. Nur): G. Angsi, SFN 9919 (Holttum).

3. Cyathea contaminans (Wall.) Copel. Phil. Journ. Sci. 4C: 60. 1909. Polypodium contaminans Wall. Cat. (nomen); Alsophila Hk. Spec. Fil. 1: 52. 1844. Chnoophora glauca Bl. (not Cyathea glauca Bory).

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Stipes stout, strongly thorny, purplish, glaucous, glabrous when mature; very young stipes clothed with pale narrow scales with dark short setæ on edges. Rachises as stipes, the upper parts less strongly thorny, but even secondary rachises somewhat prickly, hairy on the upper Middle pinnae to about 60 cm. long by 25 cm. surface. Pinnules of middle pinnæ to about 15 by 2 to 3 cm., sessile, the base truncate, the apex acuminate, the edges lobed almost to the costæ, the basal lobe free; lobes about 3 mm. wide, slightly oblique and slightly falcate, edge entire or slightly crenulate, apex rounded; veins about 10 to 12 pairs, forked or the basal ones with 3 branches; texture thin but firm; lower surface glaucous; costæ, costules and veins beneath quite glabrous, or occassionally with a few hairs or a few pale bullate fimbriate scales; sori near costules; no indusia; short paraphyses present among the sporangia, those at the base forming a ring somewhat resembling an indusium.

TYPE: Penang, Wallich 320.

This is the common tree fern on the hills, growing especially in open places and by streams. It is the largest of all the tree ferns in the Peninsula, in thickness and height of trunk and in size of fronds. It is widely distributed in the Malayan region.

PENANG: Penang Hill 1,000 feet June 1885 coll.?; Hullett s.n. Dec. 1880: 2.500 feet King's Coll. 1280.

KEDAH: G. Raya, Langkawi, 2,500 feet Haniff 15543. KELANTAN: Kuala Bedong SFN 10393 (Haniff & Nur).

PERAK: Scortechini, no locality, several sheets; Lumut, Ridley 7272 (young plant); Cottage, Ridley s.n. (small plant, fasciated frond); Larut 300-800 feet King's Coll. 4032. G. Hijau, summit, 4,750 feet SFN 12883 (Burkill).

PAHANG: P. Tioman; Bukit Surin, 1,000-2,000 feet SFN 21711 (Henderson), Tanah Runto 1,300 feet SFN 18871 (Henderson), Path across island 1,100 feet Burkill s.n. June 1915. Fraser's Hill 4,000 feet SFN 8812 (Burkill & Holttum).

SELANGOR: 15th mile Pahang Track, Ridley 8633; Ginting Bidai, Ridley 7868; Ampang Reservoir, Forest 13984 (Strugnell).

JOHORE: Bukit Soga, Ridley 11066.

 Cyathea tripinnata Copeland, Phil. Journ. Sci. Suppl. 1 p. 251. 1906.

Stipe dark, copiously short-thorny, the thorns about 2 mm. long, covered with a dense mat of small closely





Cyathea latebrosa. Two plants from Penang Hill: (above on left) Haniff 9109, (right) Hullett, Dec. 1881, \times 1.25.

appressed scales, the smallest ones pale irregular, the larger ones lanceolate with dark acuminate tip, stiffly ciliate laterally or not. Rachises dark, shortly thorny (including the secondary rachises), with short appressed hairs on the upper surface, on the lower surface dense closely appressed irregular pale scales and larger medium brown scales with dark setose edge towards tip, the larger scales not appressed. Middle pinnae to about 60 by 18 cm. Pinnules of middle pinnæ to about 9 by 2 cm., on stalks 2 to 3 mm. long, base slightly unequal, apex shortly pointed, about 10 pairs of segments free and stalked, gradually grading into sessile ones; the free segments about 2.5 mm. wide, on stalks about 1 mm. long, base slightly unequal, truncate to subcordate, of basal segments slightly broadened, apex blunt, edges crenate (basal segment with basal lobe sometimes almost free), almost at right angles to costæ, the higher ones somewhat oblique; veins about 9 pairs, mostly forked, distinct; texture thin but firm; scales on costæ beneath as on the rachises, scales on the costules rather pale with edges towards apex dark-setose, grading into pale bullate scales, fairly numerous; sori subcostular, indusia of the old sori thin, irregular.

TYPE: Mt. Mariveles, Luzon, Copeland 2068.

This species has not yet been found on the mainland of the Peninsula, but occurs on Pulau Tioman, the largest of the adjacent islands in the China sea. It has been found on Mt. Kinabalu in British North Borneo, where it is a very massive plant; the Pulau Tioman specimens are rather smaller, and were found at a much lower altitude.

PULAU TIOMAN: Bukit Telang, 800 feet, SFN 18584 (Henderson); Sedagong, 800 feet, a young plant, SFN 18617 (Henderson).

Cyathea latebrosa (Wall.) Copel. Phil. Journ. Sci. 4C:
 1909. Alsophila latebrosa Wall. Hook. Spec. Fil.
 37. 1844. Alsophila brevifoliolata v.A.v.R. Bull. Jard. bot. Buitenz. II ser. XX: 3. 1915. Plate 29.

Stipe dark, the base spiny, the spines numerous short stout; scales few except on young fronds, dark, rather narrow and thick, edge entire. Rachises dark to medium brown, subglabrous below, hairy above. Middle pinnae to about 60 by 20 cm. Pinnules of middle pinnæ to about 11 by 1.5 cm., sessile or very shortly stalked, base broadly cuneate, slightly unequal, apex gradually narrowed, acuminate, or sometimes more shortly pointed, lobed to about 1 mm. from costa, lobes separated by 1/4 to 3/4 of their own width, 2.5 to 3 mm. wide, slightly oblique, slightly to moderately falcate, the apex rounded, edges slightly crenulate to sharply

toothed; veins about 10 pairs, mostly forked, all springing from the costule, slightly prominent below but not above; texture thin; colour varying from dark to pale, more usually dark; scales on costæ beneath lanceolate to ovate acute, edges entire, thin, medium brown to pale, sometimes quite abundant, sometimes few; scales on costules ovate flat to bullate, pale, entire, varying in abundance but never very numerous; sori close to costules, sometimes very crowded, the indusium a small dark scale on the inner side; paraphyses brownish, shorter than sporangia.

TYPE: Penang, Wallich 318.

This is the common tree-fern throughout the lowlands of the Peninsula; it occurs also on the mountains up to 4,000 feet or more. Ridley and Beddome give the name var. ornata to a form with pinnules up to 3 cm. wide, the segments deeply toothed and widely separated. This grades into the typical form, and in my opinion should not be separated. It is probably not the same as Cyathea ornata (Scott) Copel. from Sikkim. Possibly C. inciso-serrata Copel. is the same as Ridley's var. ornata.

I have seen at Kew a specimen of the type collection of *A. brevifoliolata* v.A.v.R., and in my opinion it is only a small plant of this species.

KEDAH: Langkawi Islands: Curtis s.n. Sept. 1890; G. Raya, SFN 7127 (Haniff & Nur). G. Jerai (Kedah Peak): 2,500-3,000 feet, Evans & Gordon 108; Native Coll. 4183, 4699. Gurun, Native Coll. 5163; Yan, Ridley 5177.

PENANG: Hullett s.n. Dec. 1881; Ridley 7080, 12599; Curtis 537, 3074, 10141; Top of Hill, Ridley 7150; Western Hill, 2,500 feet, SFN 9109 (Haniff).

PROVINCE WELLESLEY: Tasek Gelugur, Ridley 6965.

PERAK: Larut 3-4,000 feet, King's Coll. 2359; 4,500-5,300 feet, King's Coll. 7317. Kinta, 1,500-2,000 feet, King's Coll. 7154. Maxwell's Hill 3,000 feet, Scortechini 222,223. Taiping, Curtis 10134. G. Hijau, Fox s.n. Oct. 1899. Waterfall Hill, Taiping, Ridley 3060. Bujong Malacca, Ridley 9551. G. Keledang, Ridley 9548. Temengoh, Ridley 14207. Taiping Hill; 600 feet F.M.S. Mus. 10258, 1,400 feet F.M.S. Mus. 10198 (Henderson). Jor Camp, 1,800 feet F.M.S. Mus. 10802 (Henderson). Dindings: Lumut, Ridley 10295.

KELANTAN: Kuala Pertang, SFN 10367 (Haniff & Nur). Foot of G. Stong, SFN 12266 (Md. Nur). S. Keteh at Gua Ninek, SFN 19579 (Henderson).

PAHANG: Fraser's Hill, 4,000 feet: SFN 8794, 8825 (Burkill & Holttum); Eryl Smith 814, 901. Teku, G. Tahan, SFN 8040 (Haniff & Nur). Ulu Chineras, K. Lipis,

SFN 15683 (Burkill). Pekan, SFN 17124 (Burkill). G. Gedong (Tahan), 5,000 feet, Holttum s.n. Sept. 1928.

SELANGOR: Bukit Kutu, Ridley 7865, 7866. 15th mile Pahang Track, Ridley 8663. Batang Berjuntai, Ridley 7879 (or 7870?). Dusun Tua, Ridley 7862; Jackson's Estate, Gua Batu, Ridley 8141. Klang Gates, Ridley 13439. Rantau Panjang F.R., F.M.S. Mus. 7629 (Hume). Ginting Simpah 1,800 feet, F.M.S. Mus. 8797 (Hume). Kajang, Forest 24107 (Symington).

NEGRI SEMBILAN: Sungei Ujong, Hullett s.n. Aug. 1880. G. Angsi 1,000 feet, SFN 11523 (Md. Nur).

MALACCA: Ayer Keroh, Ridley 10785. Ayer Panas, Ridley 1659.

JOHORE: Tanjong Kupang, Ridley 6551 (var. ornata), 4400. Batu Pahat, Ridley 10981, 11068. Haji Senawi, Ridley 10966. G. Panti, Ridley s.n. Dec. 1892. Temoh River, Kota Tinggi, Ridley 15969. Tempayan River, Ridley 13279. Kluang SFN 9352, 9450, 9452 (Holttum). G. Pulai, SFN 7839 (Best).

SINGAPORE: Bukit Timah, Cantley s.n. July 1885. Ang Mo Kio, Ridley 6550. S. Morei, Ridley 6552. Chua Chu Kang, Ridley 6029. Chan Chu Kang, Ridley 6123. Macpherson Road, Ridley 8936. Bukit Panjang, Ridley 12535.

Cyathea latebrosa (Wall.) Copel. var. indusiata Holttum var. nov.

A typo differt: costulis dense squamulatis, soris indusiatis, indusiis cupuliformibus.

So far as I can see, this fern is quite identical with typical $C.\ latebrosa$ except for the two points mentioned in the above diagnosis. The costæ of var. indusiata are very scaly instead of sparsely scaly, but the scales are identical. The indusia are thin and cup-shaped in mature sori, equally wide all round, or deeper on the costular side. $Cyathea\ longipinna$ Copel. seems to be exactly like var. indusiata in scaliness, but without the large indusia; I would include it also as a variety of $C.\ latebrosa$. It is possible that $C.\ latebrosa$ var. indusiata has already been described, but it is not among the many species I have examined, nor can I find it among the descriptions which I have consulted.

This variety seems to be a mountain plant in the Peninsula. It has been found at two localities on the Main Range at 4,000 and 5,000 feet, and on the summit of Gunong Muntahak in Johore. Owing to its similarity to typical *C. latebrosa*, it may have been neglected by collectors.

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PAHANG: Cameron's Highlands, Path to Telom, 5,000 feet, SFN 23539 (Holttum). Fraser's Hill, 4,000 feet: F.M.S. Mus. 11315 (Henderson), SFN 11005 (Md. Nur).

JOHORE: G. Muntahak, 2,000 feet, SFN 19910 (Holttum).

6. Cyathea obtusata Rosenstock, Med.'s Rijks Herb. Leiden 31: 1. 1917. Plate 30.

Stipes unknown. Rachises pale, subglabrous below, appressed hairy above. Middle pinnae to 50 by 18 cm. Pinnules of middle pinnæ 6 to 9 by 1.5 to 2.2 cm., sessile or the lowest slightly stalked, base truncate slightly unequal, apex shortly acute, lobed almost to costa; lobes very close together, 2.5 to 3.5 mm. wide, slightly oblique and slightly falcate, the apex rounded and very slightly toothed; veins about 7 to 10 pairs, mostly forked, all springing from costules; texture thin; colour of both surfaces rather pale when dry; scales on costæ beneath very few, on costules bullate, dark, not numerous, all entire; sori close to costules, indusia rather large, thin, irregular, flattened, usually broadest on the costular side.

TYPE: Perak, King's Coll. 7148 (cited erroneously as 1148).

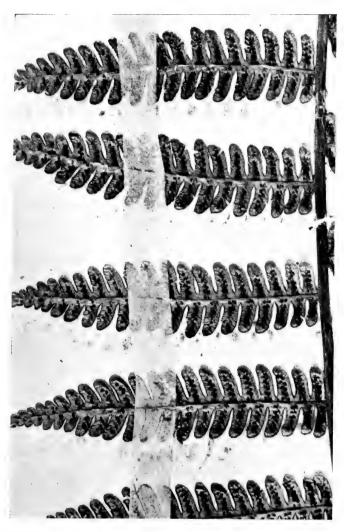
This species appears to be closely allied to C. latebrosa. The differences are the pale colour of the specimens and the presence of indusia. If the indusia were absent, I should refer them to C. latebrosa; the pale colour might be due to the preparation of the specimens. It is likely that they may eventually be regarded as a variety of C. latebrosa, comparable with var. indusiata, but with few scales.

PERAK: Near G.M., 2,000 to 2,500 feet, King's Coll. 7148. Scortechini, no locality.

SELANGOR: Kajang, Forest 22874 (Symington); a doubtful specimen.

7. Cyathea excavata Holttum sp. nov. Plate 31.

Caudex sub stipitibus pneumatophoris magnis, profunde excavatis, c. 15, figura V instructis, præditus; pneumatophora stipitum distantiora, elongata, leviter excavata. Stipites in vivo virides, adulti fere glabri, frondium juvenilium circinatarum squamulati; squamæ fuscæ, non nitidæ, tenues, integræ. Rachides in vivo virides, in sicco pallidæ, infra glabræ, supra pilosæ. Pinnae mediae c. 50 cm. longæ, 16 cm. latæ; pinnæ infimæ reductæ. Pinnulae pinnarum mediarum c. 8 cm. longæ, 1.8 cm. latæ, sessiles vel brevissime stipitatæ, basi inæquale, truncata, apice breviter acuto, marginibus fere ad costam lobatis; lobi intervallis latitudini



Cyathea obtusata. King's Collector 7148, \times 1.25.





Cyathea excavata. Holttum 23538, \times 1.25.







Cyathea polypoda. King's Collector 7129, imes 1.25.

suæ paribus collocati, c. 2.5 mm. lati, leviter obliqui, leviter falcati, apice rotundato, marginibus integris; venulae c. 10–12–jugatæ, plerumque furcatæ; textura tenuis; lamina supra et subtus glabra; squamulae costarum et costularum paucæ, tenues, applanatæ, irregulares, brunneæ vel pallidæ; sori ut videtur pauci, prope costam, in venulis infimis sedentes; indusia sororum senilium tenuia irregularia, late aperta.

Pahang: Cameron's Highlands, 5,000 feet, SFN 23538 (Holttum, Type); Cameron's Highlands, 4,800 feet, SFN

17802 (Henderson). Telom, Ridley 13932.

This very distinct species has so far only been found in the neighbourhood of Cameron's Highlands. Fully fertile fronds are much to be desired; those so far obtained are only very sparsely fertile with old sori only. The deeply excavated pneumatophores at the base of each frond are a very striking feature in the field, but are not likely to be well represented in herbarium specimens; the thin entire sparse scales are also distinctive.

8. Cyathea polypoda Baker Trans. Linn. Soc. II Bot. 4: 250. 1894. *C. kemberangana* Copel. Phil. Journ. Sci. 12C: 52, 1917. Plate 32.

Stipe pale to medium brown, the base darkened and roughened; no scales on material from Malay Peninsula, but on Kinabalu specimens base of stipe densely clothed for a short distance with pale scales, the edges shortly dark-setose. Rachises smooth and pale beneath, with pale stiff appressed hairs above. Largest pinnae to about 40 by 16 cm. Pinnules to about 8.5 by 2 cm., on stalks 1 to 6 mm. long, articulated at base, the base truncate and slightly unequal, the apex rather shortly pointed, the edge lobed 2/3 or occasionally 3/4 to the costa, the lowest lobes the deepest and sometimes the lowest basal segment nearly free; the lobes 4 to 5 mm. wide, slightly oblique, slightly falcate, rounded at apex, edges slightly toothed; texture decidedly coriaceous; veins up to about 7 pairs, on the larger segments usually several pairs forked, lowest basi-scopic vein springing directly from the costa. Upper surface usually drying dark, lower pale. Scales on costæ and costules below linear-lanceolate, stiff, medium brown, shining, the edges provided with stiff setæ; scales on costules bullate. Costæ and costules hairy above like the rachises. Sori medial, exindusiate, with dark paraphyses about equal in length to sporangia, or a little longer.

TYPE: Kinabalu, Haviland 1479, at Kew.

I have examined the type of this species. It is a single pinna of a young frond. Indusia are lacking, although Baker states that small indusia are present. The form,

venation and scales are in exact agreement with specimens collected by me on Kinabalu and stated by Christensen to agree with *C. kemberangana* Copel. The Peninsula specimens are rather smaller than those from Kinabalu, but are otherwise identical. This species is clearly allied to *C. squamulata*, differing in the distinctly coriaceous texture, less falcate pinnule-lobes, longer pinnule-stalks and in the relatively small number of scales at the base of the stipe; the rather short brown paraphyses also distinguish it from most specimens of *C. squamulata*, but there are exceptions to this (see remarks under *C. squamulata*). *C. polypoda* is evidently a fern of exposed mountain tops and ridges, as opposed to the rather shade-loving and usually lowland *C. squamulata*.

JOHORE: Mt. Ophir: Padang Batu, Ridley 9857; Тор, Ridley 865; Hullett s.n. Dec. 1883. G. Bělumut 3,300 feet, SFN 10741, 10690 (Holttum).

PERAK: Near top of G.M. 3,500-4,000 feet, King's Coll. 7129, 7229.

9. Cyathea squamulata (Bl.) Copel. Phil. Journ. Sci. 4C: 37. 1909. Gymnosphaera squamulata Bl. Enum. 243. 1823. Alsophila comosa Wall. Hook. Spec. Fil. 1: 53, t. 20A. 1844. Alsophila Ridleyi Bak. Ann. Bot. 8: 122. 1894. Cyathea Ridleyi Copel. Phil. Journ. Sci. 4C: 36. 1909. C. elliptica Copel. Phil. Journ. Sci. 12C: 51. 1917. C. paraphysata Copel. Phil. Journ. Sci. 6C: 135, t. XV. 1911. Cyathea Brooksii Copel. Phil. Journ. Sci. 6C: 135, t. XVI. 1911. Alsophila sarawakensis C. Chr. Ind. Fil. Suppl. Cyathea deuterobrooksii Copel. Phil. Journ. Sci. 38: 131. 1929. Plate 33.

Stipes dark to medium brown, densely scaly at base, scales on lower side broader and more spreading, on upper side narrower and more appressed; largest scales about 3 cm. long by 2 mm. wide, medium brown, the edges minutely dark-setose. Rachises medium brown, with appressed hairs above, sparsely scaly below with minute strongly setose scales. Middle pinnae to about 50 by 20 cm., more usually about 15 cm. wide. Pinnules of middle pinnæ to about 10 by 2 cm. (usually about 8 by 1.6 cm), on stalks 1 to 2 mm. long, the base unequal truncate, the apex rather shortly acute, lobes cut 2/3 or sometimes 3/4 to the costa; lobes 3 to 4 mm. wide, slightly oblique, midrib strongly falcate towards apex of lobe, sides parallel, the lower one curved over at apex, apex bluntly pointed, entire or slightly toothed; veins about 6 pairs, basal ones usually forked, basal vein on side towards pinna-rachis springing



Cyathea squamulata. Two plants from Penang Hill: (left) Haniff 9123, (right) Ridley 7107, \times 1.25.



directly from the costa; texture thin; colour usually dark above and paler below; surfaces and veins glabrous except for occasional hairs on veins on upper surface; scales on costæ and costules below not very numerous, on costæ lanceolate with or without paler slightly bullate base, the edges strongly setose, gradually transitional to pale bullate scales with darker setose tips on the costules; sori median on the veins, distinct from each other at maturity, not occupying the whole surface, paraphyses long pale numerous, longer than the sporangia.

TYPE: Java, in Blume's Herbarium.

The typical form of this species, from Java, has rather pale paraphyses which are only a little longer than the sporangia. I have seen a considerable number of sheets from Java, and all agree in this character, which was noted by Mettenius (Ann. Lugd. Bat. 1: 52). In characters of size, texture, venation, width and cutting of pinnules, there is much variation in the Java specimens. They tend however to be more coriaceous than the Peninsula plants; this is perhaps due to their being mostly mountain plants whereas Peninsula specimens are mostly from shady low-land forest. Some of the Java specimens match typical Peninsula specimens except for the paraphyses.

Peninsula plants nearly all have long pale paraphyses, much longer than the sporangia. The additional length is due to additional elongation of the cells. A few specimens from Penang have rather dark brown paraphyses (not very easy to observe), about as long as the sporangia. These specimens vary in size and cutting of pinnules in exactly the same way as the specimens with long pale paraphyses; specimens with long paraphyses can be found to match exactly in all other characters those with short paraphyses. It appears to me therefore that all forms must be included in one species.

There is one specimen from Gunong Panti, Johore (Ridley 4150) which has short dark paraphyses and rather long-stalked lower pinnules, somewhat intermediate between *C. squamulata* and *C. polypoda*. In texture however it is very different from *C. polypoda*, and the segments are distinctly falcate.

The size of the pinnules of *C. squamulata* varies much in different pinnæ of the same frond, and in smaller and larger plants growing side by side. The venation (number of veins and whether simple or forked) also varies considerably in different parts of the same frond. *Alsophila Ridleyi* Bak. was based on a small plant.

As normally found in the Peninsula, the species is easily distinguished by the densely scaly stipe (the scales thin and with minutely setose edges) and the pinnules cut not more than 2/3 to the costa. *C. Burbidgei* agrees in scaliness, but has densely hairy rachis and costæ beneath. In Singapore and the south of Johore *C. squamulata* is a fairly common plant near streams in forest. It has also been found in Penang, but not in the intervening parts of the Peninsula, from which further collections are needed.

The reduction of *C. elliptica* Copel. is due to Christensen (this Bulletin, Vol. VII, p. 219). I have seen specimens of the type collections of *C. Brooksii* Copel. and *C. paraphysata* Copel.; both appear to me to fall within the range of variation of this species. I have also seen the type of *Alsophila comosa* Wall.

PENANG: Without locality: Hullett s.n. Dec. 1881; Ridley 7040, 7076; Curtis 538, 10140; Bishop Hose s.n. June 1896. Penang Hill, Ridley 7017. Road to Penara Bukit, Curtis s.n. Oct. 1898. Above Ayer Itam, 1,000 feet, SFN 19339 (Holttum).

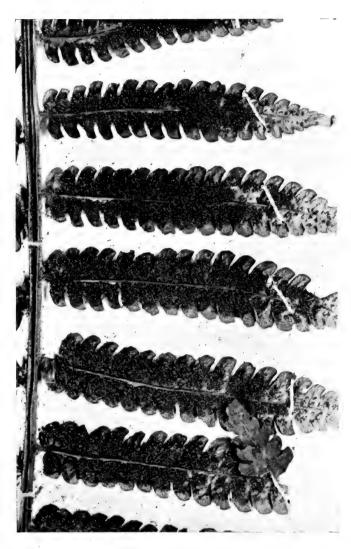
JOHORE: G. Panti, Ridley 4150 (paraphyses short dark). Mt. Austin, Ridley 12571. Sedenak, Ridley 13475. Pelepah Valley, SFN 24504 (Holttum).

SINGAPORE: S. Morai, Ridley 4401 (type of A. Ridleyi). Chan Chu Kang, Ridley 4398, 6122. Chua Chu Kang, Ridley 6031, also s.n. May 1905. Bukit Mandai, Ridley 4402. Bukit Panjang, Ridley 12537, 13313. Bukit Timah, Ridley 12557, 6549, Matthew s.n. Jurong, Ridley 5756. No locality, Cantley s.n. Aug. 1881.

WITHOUT LOCALITY: King's Coll. 186.

Cyathea obscura (Scort.) Copel. Phil. Journ. Sci. 4C: 37. 1909. Alsophila obscura Scort. Bedd. Journ. Bot. 25: 321, pl. 278, f. 2. 1887. A. subobscura v.A.v.R. Bull. Jard. bot. Buitenz. II ser. XX: 1, t. 1. 1915. Plate 34.

Stipes dark (not black) to medium brown, densely scaly at base, the scales to about 3 cm. long by 2 mm. broad, medium brown, the edges shortly dark ciliate. Rachises medium brown with appressed hairs above and minute strongly setose scales beneath. Middle pinnae to about 50 by 15 cm. Pinnules of middle pinnæ to about 8 by 1.5 cm., on stalks 1 to 2 mm. long, the base unequal and more or less truncate, the apex acute, rather shortly narrowed; lobes cut about 1/2 to 2/3 to costæ, about 3 mm. wide, slightly oblique, sides parallel, falcate at apex, apex bluntly pointed; veins about 6 pairs lowest usually forked, basal vein on side towards pinna-rachis springing directly from the costa; texture firm; colour dark above and paler beneath; surfaces



Cyathea obscura. Fraser's Hill, Holttum 21540, \times 1.25.



and veins glabrous; scales on costæ few except at base, lanceolate, brown with or without paler bullate base, edges setose, bullate scales on costules pale with dark setose apex; sori median on basal veins, becoming very crowded when mature, filling the whole surface except tips of lobes, the sporangia mixed with long pale paraphyses; no indusia.

TYPE: Perak, Scortechini.

The type of this species is presumably in Beddome's herbarium, and I have not seen it. At Singapore however there are specimens from Scortechini's herbarium labelled A. obscura, and also duplicates of Kunstler's collections named by Beddome. All these agree very well together, and I have little doubt that they represent this species. C. obscura is fairly common on the Main Range and the Taiping Hills at about 3,000 to 4,000 feet altitude. Specimens from Penang are rather intermediate between typical C. obscura and C. squamulata, and it may be that C. obscura should be regarded only as a variety of C.squamulata, differing in firmer texture, the pinnules never so deeply cut as in the largest plants of C. squamulata, and especially in the spreading of the sporangia to cover the whole lower surface of the pinnules. As in C. squamulata, young plants with only pinnate fronds may occasionally be I have seen two specimens of the type collection of A. subobscura, from Sumatra, and consider them identical with A. obscura.

PENANG: Road to Penara Bukit, Ridley 7153.

PERAK: Scortechini, s.n., 5 sheets. Larut, 3,500-4,000 feet, King's Coll. 6391. Larut, 3,000 feet, Bishop Hose s.n. March 1893. G. Hijau, W. Fox s.n. Octo. 1879. Maxwell's Hill: Ridley 5185, Curtis 2692, Anderson 140, SFN 12534 (Burkill; young plant).

Pahang: Telom, Ridley 13930. Cameron's Highlands: Robinson's Falls, 4,400 feet, SFN 23453 (Holttum); Top of Falls, SFN 17760 (Henderson; sterile specimen); Fraser's Hill: 4,000 feet, SFN 8779, 8796 (Burkill & Holttum), 21540 (Holttum).

Cyathea Burbidgei (Bak.) Copel. Phil. Journ. Sci. 4C:
 55. 1909. Alsophila Burbidgei Bak. Journ. Bot. 1879:
 38. Alsophila trichodesma Scort. Bedd. Journ. Bot. 25:
 321. 1887. Cyathea mollis Copel. Phil. Journ. Sci. 12C:
 52. 1917. C. poiensis Copel. Phil. Journ. Sci. 6C: 362.
 1911.

Stipes dark brown, roughened when scales have fallen, the base when young covered with numerous pale to medium brown scales; scales about 2.5 cm. long and 2 mm. broad, the edges with very short oblique dark setæ. Main rachis

dark, subglabrous below, smaller rachises covered with spreading hairs 2 to 3 mm. long on lower surface, and appressed hairs above. Middle pinnae to about 60 by 18 cm. Pinnules of middle pinnæ to about 11 by 1.5 cm., the higher ones sessile, the lower on stalks 2 to 3 mm. long, the base unequal, rounded, the apex shortly acuminate, the sides lobed 3/4 or more to the costæ, the basal segment often free; the lobes 3 to 4 mm, wide at their base, slightly oblique and gradually narrowed upwards, falcate, the apex subacute or rounded, subentire or slightly toothed; veins about 6 pairs, the lower ones forked, the basal one on side towards pinnarachis springing directly from the costa; texture thin; colour rather pale; costæ, costules and veins below covered with spreading pale hairs; a few lanceolate pale scales, more or less bullate at their base, mixed with hairs on the costæ, pale bullate scales with setose apices on costules, not very abundant; sori median, no indusium; paraphyses numerous long pale, much exceeding the sporangia.

Type: Borneo, Burbidge.

Christensen has previously discussed this species (this Bulletin Vol. IV, p. 379). He has seen the type, and has identified with it some specimens from the Peninsula; also $C.\ mollis$ Copel. I have examined the type number of $C.\ poiensis$ Copel. in Brooks's Herbarium, and consider it to be a small plant of $C.\ Burbidgei$.

This species also is certainly closely allied to *C. squamulata*, and might possibly be regarded as a variety. It differs chiefly from typical *C. squamulata* in the extreme hairiness of the costæ, costules and veins beneath, and appears also to be usually a larger fern with more deeply lobed pinnules. Young plants of *C. squamulata* are somewhat hairy, and could hardly be distinguished from young plants of *C. Burbidgei*. *C. Burbidgei* seems to be a species of lowland forests and the lower slopes of mountains; curiously enough, it has only been found (with the exception of a doubtful specimen of a young plant from Penang) in the middle part of the Peninsula, from which specimens of *C. squamulata* are lacking.

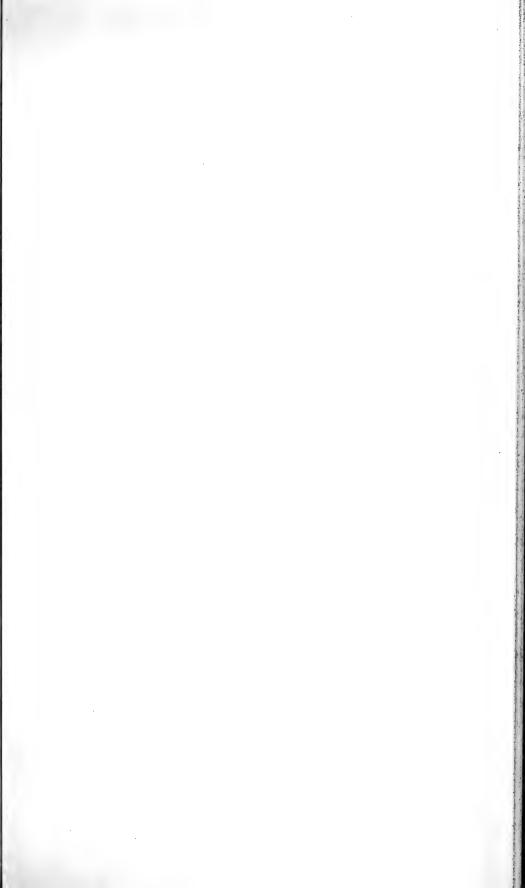
PENANG: No loc. or date, Forest Guard (young plant).

PERAK: Bujong Malacca, Wray (?), s.n. Scortechini, no locality.

PAHANG: Kuala Teku, 500 feet, SFN 20096 (Holttum).

SELANGOR: Semenyih, F.M.S. Mus. 7917, 8712 (Hume, young plant). Kajang, Forest 22867, 22930 (Symington).

NEGRI SEMBILAN: G. Angsi, SFN 9889 (Holttum). Bukit Tangga, SFN 11830 (Md. Nur).





Cyathea ampla. Holttum 19883 (largest pinnule), imes 1.25.

12. Cyathea ampla Copel. Phil. Journ. Sci. 6C: 361. 1911. Plate 35.

Stipes dark brown, slightly roughened when scales have fallen; scales at base of stipe very abundant, medium brown, to about 3 cm. long by 2 mm. broad, the edges with minute stiff dark oblique setæ. Rachises dark brown in basal parts, paler towards apex of frond, sparsely minutely scaly below, appressed hairy above. Pinnae distinctly articulted. Middle pinnæ to 60 by 22 cm. Pinnules of middle pinnæ to 11.5 by 2.7 cm., on stalks 6 to 8 mm. long, the base unequally cordate, the apex acuminate broadly toothed, the basal two segments on basal pinnules free, the rest cut 3/4 or more to the costa; segments 6 to 7 mm. wide at base, slightly oblique, slightly falcate (the lowest not falcate) the apex bluntly pointed, the edge shallowly toothed; veins 7 to 8 pairs, usually all forked except the highest, the basal one on the side towards the pinna-rachis springing directly from the costa, elevated on both surfaces, broader below and not darkened; texture firm; scales on base of costæ dark, narrow, with setose edge, mixed with very small scales of similar nature; scales at base of costules as on costæ, distal scales bullate, dark with setose tip, occasionally paler; sori nearer costules than edge, rather small and quite distinct; no indusia; paraphyses numerous pale, slightly exceeding the sporangia.

TYPE: Mt. Singgie, Sarawak, Brooks 106.

The above description is taken from the only specimens found in the Peninsula, namely SFN 19883, collected by me at 2,000 feet altitude (the summit) on G. Muntahak, Johore. I have compared these with the type number in Brooks's Herbarium, and believe them to be identical. The species is closely allied to C. squamulata, but decidedly larger in all its parts. The higher pinnæ of C. ampla would be difficult to distinguish from C. squamulata.

Cyathea recommutata Copeland Phil. Journ. Sci. 4C: 36. 1909. Alsophila commutata Mett. Ann. Lugd. Bat. 1: 53. 1863. Cyathea Hewittii Copel. Phil. Journ. Sci. 6C: 134, t. 14. 1911. Alsophila heteromorpha v.A.v.R. Bull. Jard. bot. Buitenz. II. ser. XVI: 1. 1914. Cyathea Toppingii Copel. Phil. Journ. Sci. 12C: 51. 1917.

Stipes very dark (nearly black), slightly roughened by bases of fallen scales; scales at base numerous, to about 2 cm. long by 2 mm. wide, dark with thin irregular margins, also scattered small thin pale scales; base of stipe bearing a few or several reduced pinnae 1.5 to 7.5 cm. long, 1 to 2 cm. wide, on stout stalks 1.5 to 2 cm. long, at right angles to stipe, pinnate at the base; the reduced pinnæ either in a small group at the base of the stipe only, or sometimes extending sparsely up to the normal pinnæ; reduced pinnæ

on old fronds spine-like owing to loss of leafy parts. Rachises sparsely minutely scaly below, appressed hairy above. Middle pinnae to about 40 by 15 cm., fertile pinnules contracted. Fertile pinnules 4 to 8 cm. long, 6 to 12 mm. wide, on stalks 2 to 3 mm. long, base truncate to cordate, apex acuminate, sides incised half-way to costa or a little more, lobes 3 to 4 mm. wide, oblique, bluntly acute, toothed; sterile pinnules about 9 by 1.8 cm., on stalks 2 mm. long, basal segment deeply cut, sometimes almost free, rest lobed about half-way to costa, lobes about 5 mm. wide, slightly oblique, apex rounded, slightly toothed, veins to about 7 pairs, simple, basal one not springing from costa; scales on costæ lanceolate, dark with pale edge, on costules paler, sub-bullate, edges irregular, not setose; sori subcostular, exindusiate, sometimes completely filling the surfaces of the fertile segments; paraphyses short dark not numerous.

TYPE: Malacca, Cuming 396.

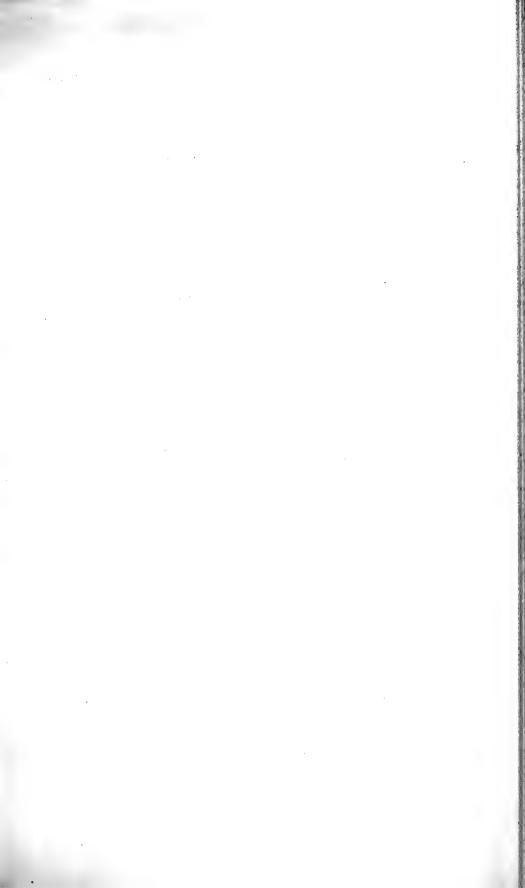
The species Alsophila commutata Mett. was based on Gymnosphaera squamulata Hk., Gen. Fil. 100, which is a description and illustration of Cuming's fern from Malacca, wrongly identified with G. squamulata Bl. In transferring the species to Cyathea, Copeland had to make another new name, owing to the prior publication of C. commutata Spr.

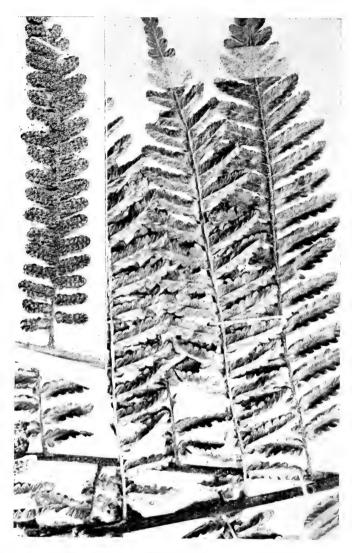
I have examined specimens of the type collection of *C. Hewittii* and *A. heteromorpha*; they appear to me quite identical with this species. The reduction of *C. Toppingii* is due to Christensen (this Bulletin, 7: 220).

This is a small, rather slender tree fern of mountain forests. The type doubtless came from Mt. Ophir, where it has been collected again. It has also been found on the Main Range, Taiping Hills, and G. Tahan, while outside the Peninsula it is known from Sumatra and Borneo. On the whole, this species is not so variable in the cutting of the pinnules as some others, but there is a rather unusual specimen (Maxwell's Hill, Haniff 9085) which has large deeply incised pinnules; the sterile pinnules are up to 11 by 2.3 cm., fertile to 9.5 cm. long, the basal segments in both sometimes free and the other segments cut nearly to the costæ.

PERAK: Scortechini, without locality (2 sheets); Larut 1,800-2,000 feet, King's Coll. 1988; Larut, near G.M., 3,000-4,000 feet, King's Coll. 7130; Bujong Malacca, Ridley 9604; Maxwell's Hill 4,000 feet, SFN 9085 (Haniff).

PAHANG: G. Tahan: Wray's Camp, Ridley 16211; 3,000-3,500 feet, SFN 20572 (Holttum). Fraser's Hill, 4,000 feet, SFN 8793 (Holttum & Burkill), 11367, 21560 (Holttum).





Cyathea Kingii. Cameron's Highlands, Holttum 23537. Largest form of sterile pinnules; on right, a fertile pinnule, \times 1.25.

SELANGOR: Bukit Hitam, Ridley 7869 (see Beddome in Kew Bull. 1902, p. 423).

JOHORE: Mt. Ophir: Ridley 3319; 3,500 feet, SFN 23705 (Holttum).

 Cyathea Kingii (Clarke) Copeland, Phil. Journ. Sci. 4C: 56. 1909. Alsophila Kingii Clarke, Bedd. Handbook Addenda 475. 1883. Plate 36.

Stipe almost black, roughened at base, scales about 1 cm. long, 1 to 1.5 mm. broad, dark with pale thin edges. Rachises almost black or sometimes purplish, subglabrous below, dark-hairy above. Middle pinnae to about 75 by 20 cm., more often about 55 by 17 cm. Fertile pinnules much contracted, about 6-9 cm. long, 0.6 to 1.2 cm. wide, on stalks 1 to 3 mm. long, base truncate, apex shortly acute, basal segment on side towards main rachis sometimes free, rest of pinnule lobed almost to costa, segments about 3 mm. wide, slightly oblique, edges slightly toothed, veins about 6 pairs, usually simple, none springing direct from costa; sterile pinnules usually about 1.6 cm. wide, occasionally up to 2.5 cm., lobes with rounded apex and edge toothed towards apex, veins usually 6 to 8 pairs, mostly forked; occasionally several basal segments of sterile pinnules are free, these segments being up to 4 mm. wide and 15 mm. long, the edges strongly toothed, having up to 10 pairs of veins, some 3-branched; scales on costæ beneath about 1 mm. long, narrow, dark, edge thin and pale, towards apex and base with brown marginal setæ; smaller scales on costules of fertile pinnules not strongly bullate, medium brown to pale, with few to many rather pale marginal setæ; bullate scales especially on some sterile pinnules, rather pale, without dark setæ; sori close to costules, completely covering lower surfaces; no indusia; paraphyses flattened shorter than sporangia.

TYPE: King's Collector 2416, Larut, Perak.

Some plants at Fraser's Hill have very large fronds, the pinnæ to 75 cm. long, the rachises medium brown, occasionally dark and purplish, but not black, the fertile pinnules to 11 by 1.7 cm., many segments cut to costæ, the upper surfaces recurved.

This species has only been found on mountains, at about 4,000-5,000 feet, in forests, especially in rather open places. The characteristic feature is the much reduced fertile pinnules. The only specimen from outside the Peninsula which I have seen in Forbes 2562 from Sumatra.

PERAK: G. Bubu, 5,000 feet, Wray 3860, King's Coll. 7402; G. Hijau, Fox s.n. Oct. 1899; Larut 5,000 feet, King's Coll. 2416 (type).

Pahang: G. Tahan: 3,300 feet, Wray & Robinson 5425; Ridley 15994; 5,500-7,000 feet, SFN 7954 (Haniff & Nur); Teku Woods, Ridley 15968 (young plant); 3,700 feet, in forest, SFN 20609 (Holttum). Fraser's Hill, 4,000 feet: Eryl Smith 833; SFN 8492 (Burkill & Holttum), 11401 (Holttum). Cameron's Highlands: Rhododendron Hill, 5,100 feet, SFN 23311 (Holttum); Path to Telom, 5,000 feet, SFN 23537 (Holttum). Kluang Terbang, Barnes 1900 (young plant).

SUMATRA: Forbes 2562 (no locality; date 1881).

15. Cyathea glabra (Bl.) Copel. Phil. Journ. Sci. 4C: 35. 1909. Gymnosphaera glabra Bl. Enum. 242. 1828. Alsophila dubia Bedd. Journ. Bot. 25: 1, t. 279a. 1883. Alsophila vexans Ces. Atti Acad. Napoli 7, pt. 8, 4. 1876.

Stipes dark purplish or almost black, with roughened base; scales fairly numerous but soon deciduous, dark with pale irregular edges. Rachises dark to medium purplish brown, subglabrous below, appressed hairy above. Lowest pinnae sometimes much reduced, especially on young low-land plants. Middle pinnae to 55 by 20 cm., more often about 45 by 15 cm. Pinnules of middle pinnæ to 12 by 2 cm., more often about 9 by 1.5 cm. and occasionally smaller, on stalks 2 to 4 mm. long, base slightly unequal, broadly rounded or subtruncate, occasionally slightly auricled on upper side, apex rather shortly narrowed and broadly toothed, edge subentire or slightly lobed, occasionally lobed as much as half way to the costa; lobes where present usually about 5 mm. wide at base, rounded, almost entire; veins 3 to 5 pairs, usually all simple, the basal vein on the side towards the pinna-rachis not usually springing directly from the costa (occasionally so towards apex of pinnule); texture thin but firm; scales on costæ and costulæ beneath not very abundant; scales at base of costa narrow, dark, with pale edges, sometimes with a few setæ; scales on costules very small, narrow, with usually pale setæ on margins; no bullate scales; sori in one or more series on either side of costæ, those on each vein-group being disposed in two close almost parallel rows, not or only slightly converging towards the margin; no indusia.

TYPE: Java, in Blume's Herbarium.

As here interpreted, this species is very variable in the extent to which the pinnules are lobed. I have examined Blume's specimens at Leiden and Kew, and also all specimens from Java in the Buitenzorg herbarium. Java specimens are much less variable than those from the Peninsula; their pinnules are usually lobed about 1/3 to the costa, occasionally almost 1/2. Of 33 Peninsula specimens

in the Singapore herbarium (counting only those with middle pinnæ), 16 have pinnules very slightly lobed, 10 lobed not more than 1/4, and the remaining 7 lobed 1/3 to 1/2. of those most deeply lobed seem to me quite indistinguishable from typical Java specimens, and as I can see no sharp dividing line between these and the less lobed specimens, I am of opinion that all should be regarded as one Beddome's Alsophila dubia was based on a slightly lobed specimen. These slightly lobed specimens are very similar to Alsophila podophylla Hk. from Siam and southern The most deeply lobed Peninsula specimen is King's Collector 2493 from Larut, Perak; this has the lowest lobes on many pinnules quite free (a condition not seen in Java specimens) and the remainder of the pinnules lobed halfway to the costa. The Peninsula specimen agreeing most nearly with those from Java is SFN 26110 (Corner) from Fraser's Hill.

A specimen from Java (Bakhuizen fil. 3121, from Soekamentri), approaches *C. gigantea* in having almost sessile pinnules, lobed fully half-way to the costa, the lobes rather deltoid and distinctly toothed; there are however never more than 5 pairs of veins.

The minute scales on the costæ and costules of this species are characteristic; in order to distinguish the setæ on their margins, a rather high magnification is necessary.

Cyathea vexans (Ces.) C. Chr. from Sarawak, of which I have examined the type, agrees closely with many Peninsula specimens.

C. glabra is a fairly common small tree fern in mountain forests; the only lowland specimens are from Singapore and southern Johore, and one from Perak. The lowland plants are usually thinner in texture, agreeing in other respects.

KEDAH: G. Jerai (Kedah Peak): Ridley 5156, 5157; 2,500-3,000 feet, Evans & Gordon 55; 2,800 feet, Robinson & Kloss 6042.

PERAK: G. Bubu, Cantley 2666. Near top of G. B. 3,500-4,000 feet, King's Coll. 7356. Larut, within 100 feet, King's Coll. 2493. Gopeng, King's Coll. 68. G. Kerbau 3,500 feet, Robinson s.n. (distr. Kew).

KELANTAN: G. Stong, 800 feet, SFN 12187 (Md. Nur).

Pahang: Telom, Ridley 13931. G. Berumban, Ridley 13932. G. Tahan: Wray's Camp, Ridley 16206, 16204; Ridley 15993; 3,500-4,000 feet, SFN 8112 (Haniff & Nur); 3,500 feet, SFN 20570 (Holttum). Fraser's Hill: F.M.S. Mus. 11485 (Henderson); SFN 8797, 8813 (Burkill &

Holttum), 11199 (Md. Nur). Cameron's Highlands 5,000 feet, SFN 23367 (Holttum).

JOHORE: Tempayan River, Ridley 13282. G. Panti 1,600 feet, SFN 15042, 17698 (Holttum).

SINGAPORE: Stagmount, Ridley s.n. 1907. Bukit Mandai, Ridley s.n. 1907. Bukit Timah, Ridley 12554.

16. Cyathea gigantea (Wall.) Holttum, comb. nov.

Alsophila gigantea Wall. Hook. Spec. Fil. 1: 53. 1846. Alsophila umbrosa Ridley p.p. J.M.B.R. Asiatic. Soc. 4: 6. 1926.

Stipes black or very dark, slightly roughened, the scales rather small, dark with pale thin edges. Rachises dark to medium purplish brown, smooth and subglabrous below, rather sparsely appressed hairy above. Middle pinnae to about 45 by 18 cm. Pinnules of middle pinnæ to about 14 by 2 cm., sessile or nearly so, the base slightly unequal, cuneate, narrowed gradually from the broadest part near base to the apex, apex acuminate, edge lobed, the basal lobes as much as 2/3 to costa; lobes deltoid, 5 to 6 mm. broad at their base, narrowed distally, slightly oblique, the apex rounded and toothed, the basal lobe occasionally almost free; veins 5 or 6 pairs in each lobe, simple, the basal one on the side towards the pinna-rachis usually springing directly from the costa; texture thin; scales on costæ and costules few, small, rather pale and irregularly lobed, the margins with short hairs but not stiff setæ except at apex of larger scales; no bullate scales; sori on basal veins distant from costules, the higher ones converging, thus forming groups of inverted V-shape; no indusia.

TYPE: Nepal, Wallich 321.

I have examined the types of both A. gigantea and A. umbrosa (from Penang) in Wallich's Herbarium at Kew, and in my opinion they represent the same species. The type of A. umbrosa has pinnæ 1.5 times as wide as those of the type of A. gigantea, but otherwise I can see little difference. A. umbrosa represents the species at its southern limit in Penang, and A. gigantea at or near its northern limit in Nepal.

The characters distinguishing A. gigantea from the more deeply lobed specimens of A. glabra are: the lobes of the pinnules more deltoid, distinctly toothed, pinnules sessile; veins in each lobe usually 5 or 6 pairs; small scales without stiff marginal setæ. For a clear comparison, middle pinnæ of well-developed fronds are necessary. Upper pinnæ often have narrower less deeply lobed pinnules.

Mr. Ridley cites a number of specimens under A. umbrosa; all of these, with the exception of Wallich 1336, are in my opinion C. glabra.

Beddome, following the *Synopsis Filicum*, regarded *Alsophila gigantea* as a synonym of *A. glabra*; his *A. glabra* from India is therefore *Cyathea gigantea*. When Beddome received the (rather aberrant) specimens of *C. glabra* from the Peninsula, he called them *Alsophila dubia*, as he had no knowledge of typical *C. glabra* from Java.

KEDAH: Langkawi Islands: Curtis s.n. Sept. 1890; G. Raya, Curtis s.n. Sept. 1890.

PENANG: Highland Hill, 500 feet, SFN 9094 (Haniff). Above Ayer Itam, 1,000 feet, SFN 19340 (Holttum).

LOWER SIAM: Kopah, SFN 2092 (Haniff & Nur).

Collectors' Numbers quoted in this Paper

The following lists give the collectors' numbers in numerical order, and in brackets after each the number of the species as arranged in this paper (e.g., 1 is *Cyathea Brunonis*). Unnumbered specimens are not quoted here.

Singapore Field Numbers— 9263 (1) 2092 (16) 12091 (1) 19883 (12) 7127 (5) 9352 (5) 12187 (15) 19910 (5 var.) 7939 (5) 9450 (5) 12266 (5) 20096 (11) 7954 (14) 9452 (5) 12269 (2) 20570 (15) 8038 (1) 9889 (11) 12534 (10) 20572 (13) 8040 (5) 9919 (2) 12883 (3) 20609 (14) 8112 (15) 10367(5)13217 (1) 21540 (10) 8492 (14) 10393 (3) 15042 (15) 21560 (13) 8779 (10) 10690 (8) 15683 (5) 21711 (3) 8793 (13) 10741 (8) 17124 (5) 22508(1)8794 (5) 11005 (5 var.) 17698 (15) 23311 (14) 8796 (10) 11199 (15) 23367 (15) 17760 (10) 8797 (15) 11367 (13) 17802(7)23453 (10) 8812 (3) 11399 (1) 18584 (4) 23537 (14) 11401 (14) 8813 (15) 18617 (4) 23538(7)8825 (5) 11519 (1) 18871 (3) 23539 (5 var.) 11523 (5) 8826 (1) 19339 (9) 23705 (13) 19340 (16) 9085 (13) 11535 (1) 24504 (9) 9094 (16) 11635 (2) 19341 (2) 9109 (5) 11830 (11) 19579 (5)

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Mr. Ridley's Series-
  865 (8)
                6550 (5)
                              8633 (3)
                                            12599 (5)
 1659(5)
                6551 (5)
                               8663 (5)
                                            13279 (5)
 3060 (5)
                6552(5)
                               8936 (5)
                                            13282 (15)
                6965 (5)
 3319 (13)
                              9548 (5)
                                            13313 (9)
                7017 (9)
                              9551 (5)
 3540 (1)
                                            13439 (5)
 4150 (9)
                7040(9)
                              9604 (13)
                                            13475 (9)
 4398 (9)
                7076 (9)
                              9857 (8)
                                            13930 (10)
 4401 (9)
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                             10173 (2)
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                7151 (2)
                             10785 (5)
                                            13932 (15)
                7152(2)
                             10966 (5)
                                            14207 (5)
 5156 (15)
 5157 (15)
                7153 (10)
                             10981 (5)
                                            15968 (14)
                             11061 (1)
                                            15969 (5)
 5177 (5)
                7272(3)
 5185 (10)
                7862(5)
                             11066 (3)
                                            15993 (15)
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                7865 (5)
                             11068 (5)
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                                            16204 (15)
                                            16206 (15)
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                             12537 (9)
                             12554 (15)
                                            16211 (13)
 6122(9)
                7869 (13)
 6123(5)
                                            16214 (1)
               7879 (5)
                             12557 (9)
               8141 (5)
 6549 (9)
                             12571 (9)
F.M.S. Museums Series-
    7617 (1)
                 8712 (11)
                             9635 (2)
                                          10258 (5)
    7629(5)
                 8797 (5)
                             9793 (1)
                                          10802(5)
                 9547 (1)
                                          11315 (5 var.)
    7673 (1)
                            10098 (1)
                 9548 (1)
                                          11485 (15)
    7889 (1)
                            10198(5)
    7917 (11)
                 9562 (1)
                            10201 (1)
King's Collector-
      68 (15)
                 2359(5)
                             6391 (10)
                                           7229 (8)
                             7129 (8)
                                           7317 (5)
     186 (9)
                 2416 (14)
                                           7356 (15)
     475 (1)
                 2493 (15)
                             7130 (13)
                                           7402 (14)
    1280(3)
                 4032 (3)
                             7148 (6)
    1988 (13)
                 4885 (1)
                             7154(5)
Forest Department—
   13907 (1)
                            22867 (10)
                                          22930 (10)
               14610 (1)
   13984 (3)
                                          24107 (5)
                22813(1)
                            22874 (6)
C. Curtis's Numbers-
     537(5)
                 2692 (10)
                            10134 (5)
                                          10140 (9)
     538 (9)
                 3074(5)
                            10139 (2)
                                          10141 (5)
Scortechini 222 (5), 223 (5), 239 (1).
Wray & Robinson 5379 (1), 5425 (14).
Evans & Gordon 55 (15), 108 (5).
Derry 92 (1).
Anderson 140 (10).
Wray 3860 (14).
Eryl Smith 814 (5), 833 (14), 901 (5).
Robinson & Kloss 6042 (15).
Forbes 2562 (14).
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PALMÆ MALESICÆ

IV.-Rattans described in Blanco's Flora de Filipinas

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Many attempts have been made to interpret the rattans in Fr. Manuel Blanco's Flora de Filipinas (published in Manila in 1837), the latest among them being Merrill's (1918). The earliest interpretations were by MARTIUS (1850) who probably allowed himself to be guided in his work by the frequency with which the species were then collected in the neighbourhood of Manila where Blanco's studies were mainly carried out and also perhaps by their utility about which mention was made by Blanco himself. FR. NAVES (1882) who lived in the Philippines may have identified Blanco's species through a study of the vernacular names and the economic uses, but, as his notions over the specific delimitations of a rattan species were so wide as to enable him to lump together distinct species, his interpretation is not of much scientific value. VIDAL (1883 & 1886) who was better acquainted with rattans and who also worked in the Philippines tried to identify two of Blanco's species one of which has proved to be correct. The most important contribution to the subject was made by BECCARI who, in addition to geographic and economic reasons, tried to detect in Blanco's specific descriptions diagnostic characters that would apply to the Philippine species. Even with such a study Beccari admitted that his interpretation was only tentative and not final, and so in the works published in 1908, 1911, 1913 and 1919 no changes of importance in the nomenclature of the Philippine rattans are involved on the basis of this interpretation. MERRILL (1918) however, published an extensive commentary on Blanco's Flora in which he paid great respect to the vernacular names and economic uses given by Blanco and as a result of study of these names, of the uses of the rattans in the Philippines and of their geographical distribution rather than of Blanco's botanical descriptions he made certain identifications either confirming, or dissenting with, those of previous authors. Accordingly he made several changes in the nomenclature of the Philippine rattans involving in some cases new combinations (cf. also Merrill, 1922).

This procedure adopted by Merrill is most unusual. A field botanist often gets a guide inexperienced in the vernacular names of plants and so the information recorded in the field pertaining to vernacular names and economic

uses of a plant is frequently erroneous. Further the intercourse of different tribes or races in a place or the gradual extinction of a plant in the locality due to cutting down of the surrounding forest results sometimes in a gradual change in the vernacular nomenclature. Even Blanco himself, after taking sufficient care to see that the vernacular names incorporated in the book were correct, warned the readers in his preface against taking them as the sure guide in identification of the plants especially because of "the intolerable easiness with which they change and occasion disappointment". (Sin embargo nadie expere hallar en los nombres una total seguridad, pues es intolerable la facilidad con que los mudan y transfornan). On the other hand Blanco, without being a trained botanist, drew his specific descriptions from a field study of the plants and sometimes made these descriptions sufficiently exten-Commenting on the very unfavourable criticisms made by the European botanists on Blanco's Flora, Merrill himself writes thus:-

"Considering the circumstances under which it was written, Blanco's Flora de Filipinas, even if it is a curious work, is also a remarkable book in some respects. botanists in any country or in any time have laboured under greater disadvantages, and Blanco must be credited with initiative, industry, and perseverance. Most of the facts recorded are the result of his observation, and even if he did make numerous grave errors in interpretation of species. his descriptions, as such, on the whole compare favourably with those of his contemporaries. In fact his descriptions in general, on account of their length, are distinctly superior to very brief diagnoses appearing in the older botanical literature as a means of interpreting the species intended. The fact should not be overlooked that species proposed by the early European authors, frequently very imperfectly characterized, are more often interpreted by an examination of the actual type specimens preserved in various public and private herbaria, than by the descriptions themselves; in fact a very high percentage of all species described are more or less unintelligible without access to the actual specimens, or duplicates of them, on which they were based. Unfortunately Blanco preserved no herbarium material, and accordingly his species must be interpreted solely by the published data." (1918, p. 24. The italics are mine).

Merrill's novel procedure in interpreting Blanco's species and, at the same time, his assurance that Blanco's descriptions were a result of personal observations and were of sufficient length to be worthy of regard induced me to consult the first edition of Blanco's *Flora* and to see whether the rattans listed could be identified on their descriptions.

Since the conclusions I have arrived at were unexpected I may be excused for dealing with them somewhat lengthily.

In studying Blanco's species one must be prepared to make several allowances. Blanco acknowledged that he had had no botanical training and made no claim to being a He wrote his book for his own use as a hobby; but he was urged to publish it by "some persons who had heard of my work". Further it must be remembered that until recently several botanists described palms in wrong terms, this being especially the case with the descriptions of rattans where the long cirrus to the leaves might be mistaken for a young shoot. This means therefore that one must be prepared to find quite wrong use of botanical terms in the descriptions of the rattans. To my surprise I have found that an adequate allowance has not been made for such eventualities in Blanco's descriptions of the rattans so that it has been difficult to interpret his descriptions. I shall consider here the most important terms in these descriptions that require definition if one is to understand Blanco correctly:

HoJas: Until recently palm leaves were "branches" to non-botanists, the leaflets being regarded as the real leaves (The other extreme was to regard as compound leaves, branches of definite growth found in such plants as Phyllanthus spp. cf. Roxburg's Flora Indica). To Blanco the real rattan leaf is also a "branch" and the leaflets are "leaves" (Hojas), and when he speaks of the Hojas arising from "los nudos de tallo" he apparently means that the leaflets arise from the leaf-rachis more or less at places marked by hooked spines beneath, regarding these claws as signs of the nodes (nudos). Since he describes in distinctive terms the Hojas (leaflets) which are alternate or in groups, I think I am justified in taking Hojas casi opuestas aladas to mean that the leaflets are close and equidistant and therefore "almost opposite", a condition not usually found in other leaves where the leaflets are inequidistant or very far apart.

Hojuelas: But if this be granted, what are Blanco's Hojuelas? Blanco must have read descriptions of some Calamus species where leaflets are described and perhaps interpreting the term leaflets (hojuelas) in its literal sense meaning "small leaves" he must have taken it to mean the shorter leaflets that are usually found at the apex of the leaves; or it is possible that he used this term when he wished to describe the characteristics of each one of the leaflets. In Blanco's descriptions both Hojas and Hojuelas mean leaflets.

PECIOLOS: If Hojas and Hojuelas be both taken to mean leaflets, it is natural to question the status of Blanco's term Peciolos, for rattan leaflets are sessile. In his descriptions Blanco uses this word twice, once under C. usitatus and again under C. maximus, and once again in describing the way the Philippine people manage to get rid of the spines off the rattans; and it appears from these references that Blanco uses the term in its correct botanic sense to mean petiole. It is strange that while Blanco uses the word tallo or tronco to mean the real stem as well as the leafrachis, he should use an appropriate term to denote the petiole. [I have known people call the coconut leaves branches and yet use word leaf-stalk to mean petiole].

If these interpretations regarding *Hojas* and *Hojuelas* are not accepted, then Blanco's descriptions which were drawn after an actual study of the plants become at once fantastic and impossible of any interpretation except in the way Merrill has done, that is, by attaching the greatest importance to the vernacular names and the economic uses which were cited on the authority of native helpers. Blanco speaks of *Hojas* being ensiform (figure de espada), opposite or alternate, solitary or in groups of twos or threes, etc.—characteristics which can never be applied to the real leaves of rattans. If on the other hand this interpretation is accepted then the species become less confusing than they are hitherto supposed as will be seen from the interpretations given below.

Calamus gracilis Blanco.

This binomial being antedated by *C. gracilis* Roxb., Kunth (*Enum. Plant.* III, 1841, p. 595) proposed the new name *C. Blancoi* for Blanco's *C. gracilis*. Naves (1882) identified this species with *C. buroensis* Mart. probably because of the resemblance of the leaves of the latter to those of a plant identified by him as the *Talola*—the vernacular name quoted by Blanco under *C. gracilis*. Beccari (1902 p. 204) enumerated the following synonyms under *C. Blancoi: C. brevifrons* Mart., *C. parvifolius* Vidal., and *C. usitatus* Blanco sensu Mart. In the *Calcutta Annals*

(1908 p. 216) Beccari excluded from C. Blancoi the synonym C. usitatus Blanco sensu Mart. because he found it was actually the female of C. mollis Blanco sensu Martius, Beccari, etc. and explained the status of his identification thus: "This [C. Blancoi] is a much more slender plant than C. mollis, but is however very closely related to, and possibly only a variety of that species

Confirming the identification of Beccari, Merrill (1918 p. 86) wrote thus: "This species is manifestly very closely allied to Calamus usitatus Blanco (C. mollis Auct., non Blanco) and is perhaps identical with it. I have seen no specimen of Cuming 1225, or Loher 1376, on which Beccari based his conception of Calamus Blancoi but our Batangas material of talola [the vernacular name given by Blanco] seems to agree with the figure given by Beccari, taken from Cuming 1225, and with the description..... Batangas is the only province, so far as our collections and data show, where talola is in use as a name for Calamus, and it is apparently generally applied to the specific form distributed herewith. The closely allied Calamus usitatus Blanco (C. mollis Auct., non Blanco) is known in the same locality as talolang lutukan. The striking differences are that in Talola the leaflets are constantly solitary, while in talolang lutukan, and in very many of our numerous specimens of Calamus usitatus some of the leaflets are frequently paired on the same side of the rachis. It was erroneously reduced by Naves to Calamus buroensis Mart., a species that does not extend to the Philippines."

As to the vernacular name talola, I find it mentioned by Merrill (1922, I p. 153) also under C. siphonospathus which shows that it may not be a sure guide in the identification of the species. According to Mercado (1880 p. 50), the talola is a slender rattan sometimes attaining the thickness of a thumb—a probable reason why it was called gracilis by Blanco—and both Mercado and Blanco state that it is a source of the rattans used by the magistrates (ministros de justica) [for punishing criminals]. It appears to me therefore that the word talola was commonly used in and around Manila for any Calamus that supplied the thin rattans used in the courts of justice and it is extremely doubtful whether Blanco or a Filipino would have been able to distinguish between C. usitatus Blanco

sensu Merrill and C. Blancoi Kunth sensu Beccari and say from which of the two the magistrates derived their canes, especially when the canes are so much alike as to puzzle even expert botanists.

Further Blanco says that the leaflets in *C. Blancoi* Kunth (= *C. gracilis* Blanco) are very often grouped in pairs on each side of the rachis, the pairs sometimes being opposite and sometimes alternate in one and the same leaf or plant (*Hojas ya opuestas ya alternas, aladas de dos en dos, y tambien simples*). The only species to which this description applies is *C. mollis* Blanco sensu Naves and Beccari which is identical with *C. usitatus* Blanco sensu Vidal and Merrill. Being also very common (*mui comun*) as stated by Blanco, in the neighbourhood of Manila, it was probably also a source of *Talola* used in the Manila courts. *C. Blancoi sensu* Beccari and Merrill, on the other hand, has leaflets which are usually solitary and is also a rare plant in the Philippines. As to the spinescence of the leaflets, *C. usitatus sensu* Vidal and Merrill is extremely variable, and one could establish several varieties on this character.

Therefore I consider the name C. Blancoi Kunth (the type of which is C. gracilis Blanco) should be given to the plants referred by Martius, Naves and Beccari to C. mollis Blco. and by Martius, Vidal and Merrill to C. usitatus Blco. Calamus Haenkeanus Mart. is also to be referred here. But C. brevifrons Mart. which was hitherto regarded as a synonym of C. Blancoi Kunth is a different species and becomes a valid name of which C. parvifolius Vidal (non Roxburgh) is a synonym. C. buroensis Mart. to which C. gracilis Blanco (= C. Blancoi Kunth) was referred by Naves does not occur in the Philippines.

Calamus maximus Blanco.

This was until recently listed as an unidentifiable species and Naves (1882) suggested that it may be a mixtum compositum. In 1904, however, Beccari thought that he recognised it in a Philippine plant communicated to him by Merrill sub. no. 1893; later, as a consequence of an examination of more extensive material from the Philippines, Beccari (1905) relegated Blanco's species as a synonym of C. ornatus var. philippinensis, making Merrill's specimen the type of a new species, C. Merrillii Becc., a view upheld by him in his later works (1908; 1919). A difficulty however arose from this interpretation, for the leaflets in C. ornatus v. philippinensis are without any bristles on their costæ, whereas in C. maximus they are described as having bristles on their two lateral nerves above and the median nerve beneath. Beccari explained away this difficulty by

supposing that the leaflets of younger plants are perhaps spiny according to the description, for he had noticed a very similar phenomenon occurring in the Malayan forms of C. ornatus, which are also quite bare in their advanced stages.

Merrill however does not accept this interpretation by Becceri and upholds Beccari's original interpretation as correct on the grounds that the natives still apply almost exclusively the word Palasan [one of the vernacular names quoted by Blanco] to C. Merrillii, and Limoran¹ to C. ornatus var. philippinensis and that Blanco's description of the leaflets "applies unmistakably" to C. Merrillii. Now Blanco describes the leaflets thus: "Hojuelas lanceoladas, con tres nervios notables, y en los dos laterales una hilera de pelos tiesos en la pagina superior y en la inferior una so hilera de lo mismo" (leaflets lanceolate, distinctly 3-nerved, armed with rigid hairs along the two lateral nerves above and along one [median] nerve beneath).

Against Merrill's interpretation one can raise equally The leaflets of C. good objections as against Beccari's. Merrillii are provided on the nerves with very long setæ which by no means can be said to be rigid (tiesos) and which are found many times on both surfaces and the leaflets are not lanceolate but what Blanco would have called de figura de espada (ensiform). Further judging from the vernacular names cited by Naves (1882) the word Palasan had been applied to more than one species in the Philippines. If one disregards the hairiness on the leaflets and attaches more importance to the economic uses mentioned by Blanco, there appears to be stronger reasons in favour of Beccari's interpretation than that of Merrill's. Blanco says that C. maximus is a common and well-known rattan, the native using its strips for various and delicate wicker works and that its fruits are edible with a not unpleasant taste. [Mercado mentions practically all these uses under the rattan Palasan p. 50]. Among the various vernacular names given by Blanco there occurs not only the word Palasan but also Calapi, the latter being used, according to Blanco, in two native dialects. Now C. ornatus v. philippinensis has not only lanceolate leaflets and una semilla oblonga com cuatro angulos confusos (oblong, obscurely 4-angled seeds) as Blanco describes, but is also called Calapi in the vernacular language and has economic uses like the one mentioned by Blanco. I may be allowed to quote here from Elmer's field-notes edited by Beccari in Elmer's

^{1.} The vernacular name Limoran has been quoted by Beccari (1913, p. 126) under C. discolor var. negrosensis Becc., but from Merrill's account (1922, p. 148) it appears that the name should have been spelt as Simoran or Simuran, for Merrill quotes the last name and not the one quoted by Beccari.

On C. Merrillii Elmer's field-notes run thus: "A very coarse and practically worthless rattan. The Manobo name is Palasan."

But returning to Blanco's original description, it appears that Blanco based most of his specific description on a flowering specimen collected by him in the jungle, while the description of the frutis and the enumeration of its vernacular names and economic uses may have been added after its identification by some inexperienced native guides. with Calapi of the markets; for what impressed Blanco most about C. maximus was the peculiarly shaped spathes and spathels in the inflorescemce, of which organs he does not make any mention in the description of other species. He describes the inflorescence thus: "Flores en panojas compuestas de espigas, con las florecillas distichas y mui apretadas; cada espiga tiene en la base un involucro de figura de embudo. Cada florecilla tiene igualmente en la base una escama de la misma figura." Considering that in a non-technical language Espiga may be used for a partial inflorescence and that modern terminology of Calamus inflorescence was not known even in quite recent times, I translate Blanco's text thus: "Inflorescence paniculately branched, the flowers being distichous and very close. the base of each partial inflorescence (espiga) there is a funnel-shaped spathe (un involucro de figura de embudo). The base of each flower (i.e. involucrophore), has also a similarly shaped spathel (escama)." Now C. siphonos-Mart. is the only species that satisfies these conditions regarding the inflorescence and which would have attracted the attention of even an untrained botanist like Blanco to the infundibuliform spathes and spathels, and that has at the same time lanceolate, almost opposite (casi opuestas aladas) and, therefore equidistant leaflets bearing spines on both surfaces. This species is extremely variable

as regards the spinescence on the leaflets, and though one very often gets forms having leaflets spiny along the three nerves above and only the midrib beneath, it is possible that Blanco had a specimen where only the lateral nerves above and the midrib beneath had spines. It is also a species that is quite frequent in the neighbourhood of Manila.

I consider therefore that *C. maximus* Blco. should stand for the plant described by Martius as *C. siphonospathus*. *C. Merrillii* Becc. becomes therefore a valid species. *C. albus* Pers. and *Daemonorops melanochaetes* Bl., which together with *C. siphonospathus* Mart. were referred by Naves to *C. maximus* Blco., are extra Philippine species.

Calamus mollis Blanco.

Martius was the first botanist to identify this species. In the Synopsis (1850, p. 336) he described it at length basing his description, as pointed out by Beccari (1908), on a male specimen collected by Gaudichaud in the Luzon island of the Philippines. As Martius referred his specimens to Blanco's species principally on the basis of the uses given by Blanco and on its occurrence in the neighbourhood of Manila, and not on Blanco's botanical description, he could not be sure of his identification. Naves (1882) who had access to Vidal's herbarium, which had been worked out with the aid of Martius, recognised C. mollis in C. Haenkeanus Mart. He illustrated a plant showing both the male and female spikelets as C. mollis Blco. with C. Haenkeanus Mart. as synonym. Vidal (1883) depicted an identical plant with its male and female parts under C. usitatus Blco. with a note that the species was cultivated under that provisional name in the Botanical Gardens in Manila; and later (fide Beccari 1902 & 1908) he identified with C. mollis Blco. a plant identical with *Daemonorops Gaudichaudii* Mart. Beccari (1908, p. 214) pointed out that Martius's C. usitatus was in fact the female of C. mollis Blanco sensu Mart. This was perhaps the reason for divergence of opinions between Naves and Vidal (both of whom worked in the Philippines) regarding the identity of C. mollis and C. usitatus. Beccari agreed with Naves's interpretation of C. mollis Blco. but did not feel himself "quite certain that the Calamus named by Martius as C. mollis is really that published by Blanco under this name, but in the absence of authentic specimens of the true C. mollis, I have followed Martius." In another place of the same monograph (p. 37) he wrote thus of the species: "C. mollis is apparently a common species in Philippines for it has been met with again and again by all modern botanists and we may consider its identification as assured."

Merrill (1918) did not agree with Beccari's interpretation and identified the species (C. mollis Blco.) with C. usitatus Blco. sensu Beccari (i.e. Daemonorops Gaudichaudii Mart.) transferring the name C. usitatus Blanco to what Beccari had called C. mollis Blco., thereby restoring to C. usitatus Blco. the interpretation originally given by Martius (partly) and Vidal. Merrill's reasons for this interchange of names was that the leaf characters and the vernacular names Uay quoted by Blanco under C. usitatus agreed well with the plant named C. mollis by Beccari, while the vernacular name Ditan quoted under C. mollis, the nonedibility of the fruits and the general description of the species agreed with D. Gaudichaudii. Hence he made a new combination of C. mollis under the genus Daemonorops.

In the first edition of Blanco's *Flora* it is recorded that the fruits are non-edible, but in the later editions a further information is added: "En el vocabulario tagalo, se dice que es venenosa; y en efecto el fruto no es comestible." I have not seen anywhere else remarked that *D. Gaudichaudii* is a poisonous (*venenoso*) rattan, while Elmer's field notes (Beccari, 1919-b, p. 3032) say that the fruits are sweet. As to the vernacular name *Ditan* Merrill himself (1922, p. 157) quotes it also as a local name for *D. ochrolepis*.

However from Blanco's description of the perianth a point hitherto overlooked—it is evident that C. mollis Blco. is a true Daemonorops and not a Calamus. Blanco had an occasion to examine the perianth of other rattans, but only of this species he uses the word Pequenisimas (very small or minute) to describe the size of the calyx, mentioning at the same time that the corolla is larger. description of the perianth unmistakably applies to a Daemonorops with a particularly short calyx. according to my interpretation of Blanco's descriptions, the leaflets are ensiform and arise more or less at a place which on account of the claws on the dorsal side looks like node (salen en los nudos del tallo). This means therefore that the leaves of this Daemonorops bear approximately as many pairs of leaflets as there are claws on the laminar part of the rachis, and that the leaflets are more or less equidistant or subequidistant. In all these characters Merrill's identification appears to be correct and as Daemonorops Gaudichaudii Mart. is the one common species of Daemonorops in the vicinity of Manila, Merrill's identification is supported by this additional evidence.

In view of this I regard *Daemonorops mollis* (Blanco) Merrill (of which *C. mollis* Blco. is the type synonym) as a legitimate name for a plant described by Martius as *D*.

Gaudichaudii and interpreted as C. usitatus Blco. by Beccari. C. mollis Blco. sensu Martius, Naves and Beccari is, as shown above (cf. the discussion under C. gracilis Blco.), a synonym of C. Blancoi Kunth.

Calamus usitatus Blanco.

As explained above (vide the discussion under C. mollis) Martius identified this species with a female plant, the male of which was thought by him to represent *C. mollis* of Blanco. Naves (1882) regarded Blanco's species as a mixture of two species, one being a true *Calamus* (*C.* psicarpus Bl.) and the other a Daemonorops (D. Rumphii Mart.). Naves did not state his reasons but, as pointed out above, he may have been led to these conclusions through a study of the vernacular names and the uses of the plants in the Philippines. Vidal (1883) depicted as *C. usitatus* a plant identical with *C. mollis* Blanco sensu Naves and Beccari. Beccari, however, reduced this to *D. Gaudichaudii* and explained his reasons for doing it thus: reduced Calamus usitatus of Blanco to Daemonorops Gaudichaudii more by exclusion than by the vague characters assigned to it by that author. In fact I consider C. usitatus to be a Daemonorops chiefly by reason of the character Blanco gives of its calyx "persistente de seis piezas, las tres exteriores mas grandes". No doubt that by calyx Blanco really means the perianth and the assertion that the 3 external parts of it are larger than the internal may be a slip for the reverse. Now there are no Calami that have the corolla of the female flowers much larger than the calyx. The globular and apparently large fruit (as it is said that the involucre of its seed is edible) and its frequency near Manila whence no other species of Daemonorops is known, are the reasons which have induced me to identify C. usitatus with D. Gaudichaudii" (1908 p. 159).

On these reasonings Merrill disagreed with Beccari and regarded Blanco's species as true Calamus and precisely C. mollis Blanco sensu Naves, and Beccari (i.e. C. usitatus Blanco sensu Mart., and Vidal). His reasons are as follows: "Beccari has interpreted Calamus usitatus to be a Daemonorops chiefly from the calyx characters given by Blanco. I interpret it especially by the leaf characters given by Blanco, its great abundance at low altitudes in the provinces contiguous to Manila, its edible fruits, and the almost universal and nearly exclusive use of the native name uay for this plant."

I have no acquaintance with the Philippine peoples nor with their dialects, and I think it is too much to expect such an acquaintance from an ordinary student of a flora of that country. But it is interesting to note that, according to

Mercado's studies (op. cit. p. 50), the Philippine vocable Ouay (uay or uai being only its variants) is a generic name of the rattans and therefore corresponds to the Bejuco of the Spanish. Further I find that the word is mentioned by Merrill in his Enumeration (I, 1922) under the following species: C. arugda; C. Blancoi (spelt as u-uai); C. grandifolius; C. ornatus v. philippinensis; C. usitatus Blanco sensu Merrill and also its var. major; and D. Gaudichaudii; and in a subsequent volume of the same work (IV, 1926, p. 38) Merrill states that the triphthong Uai merely means "rattan" so that it is used as a suffix to indicate climbing, rattan-like plants. Further under C. usitatus, Blanco also mentions the vernacular name Yantoc which according to Mercado (p. 50) is distinctive name for a Calamus sp.: but Merrill (op. cit. I, 1922) quotes it under C. Blancoi, C. spinifolius, C. usitatus Blanco sensu Merr., C. Vidalianus and D. Gaudichaudii and in the final volume of the work (IV. 1926, p. 26) he has noted that this vocable is used in the Philippines in a generic sense for the species of Calamus and Daemonorops. This means that both vernacular names quoted by Blanco lack precision and cannot therefore be used in a decisive interpretation of the species. As to the leaf-characters, it is evident that Merrill overlooked the characters given by Blanco under the term Hojas; for C. usitatus Blanco sensu Merrill (=C. Haenkeanus) has leaflets which are subequidistant or inequidistant, whereas Blanco describes C. usitatus, thus:

"Hojas ya opuestas, ya alternas aladas, de dos en dos o' de tres en tres, sin rodear al tronco sino en los nudos. Hojuelas lanceoladas con tres nervios, y en ellos en la pagina superior y en las orillas, hai una hilera de espinas." Bearing in mind the considerations I have made in the introduction of this paper I translate this text thus: "Leaflets are borne in groups of twos or threes but do not surround the rachis, though from the point of attachment they spread in all directions (sin rodear al tronco sino en los nudos), the groups themselves being now opposite now alternate. They (leaflets) are lanceolate and three-nerved and are armed with spines along the three nerves above and along the margins."

Now C. ramulosus and C. microsphaerion are the only species from the Philippines to which this description of the leaflets can apply. But since Blanco described the petiole (which in Blanco's sense includes also the leafsheath) being full of spines (llenos de espinas) and as in C. microsphaerion the petiole is quite unarmed and the leaf-sheath is smooth or sometimes sparingly spinous, C. microsphaerion could not be Blanco's C. usitatus. This means that Blanco's species should be identified with C.

In this last, however, the petiole is very small ramulosus. or absent, though the leaf sheath is much armed with spines; but Blanco might have imagined that this absence of the petiole was due to its being expanded for almost all its length into a sheath and therefore remarked in the specific description that the petiole is long-sheathed (Peciolos envainan largamente al tallo). This species is very scarce in the Philippines being found only once in the Province of Tayabas which is not very far distant from the principal area explored by Blanco; but it is possible that it was formerly more frequent and that perhaps by reason of its uncontrolled exploitation by the natives it became scarce, just as it is apparently the case with the allied species C. microsphaerion which, owing to its rareness and discontinuous distribution in widely separated places from the Bataan Province of the Luzon Island, to the island of Culion and Palawan, appears to have been formerly more frequent and abundant. But there is no evidence to show that in Blanco's time C. usitatus Blco. was a very common rattan; nor can one infer from Blanco's treatment that the rattan was by any means common or that it occurred in the neighhourhood of Manila; for it is the only rattan regarding the distribution and frequency of which Blanco did not express any opinon in his Flora, though he noted that the plant was well-known to the natives. May not this silence and the fact that he described only the fruiting perianth, and not the perianth of the flowers as in other long descriptions mean that even in Blanco's time this plant was by no means abundant and that for this reason he could not obtain flowering specimens for his description? It is also possible that the specimen was obtained for him by the natives of the place who, he said, were well acquainted with the plant.

 $C.\ ramulosus$ as described by Beccari has leaflets which are quite unarmed on both surfaces, while $C.\ usitatus$ Blanco is described to bear spines in the three upper nerves of the leaflets; but from the analogy it is not improbable that the younger stages of $C.\ ramulosus$ produce leaflets bearing spines in the three nerves on the upper surface. Regarding the armature of the leaflets, it may be remarked that $C.\ Haenkeanus$ Mart. (= $C.\ Blancoi$ Kunth as interpreted here) with which Blanco's $C.\ usitatus$ has been identified by Merrill has leaflets which are spiny in both surfaces and not, as in Blanco's species, only in the upper surface, though in the former species the spines on the lateral nerves may be absent. $C.\ ramulosus$ Becc. has also globose fruits with scales coloured red-brown along the margins (escamas coloridas).

Now coming to the difficulty of interpreting Blanco's description about the perianth in which he says that the three segments of the outer whorl of the perianth are larger than those of the inner one, it must be remembered that Blanco described the perianth from fruiting specimens (for which reason he described it as persistent). If a person unacquainted with the morphology of Calamus were to look at the fruiting perianth, he might easily overlook the calvx segments and mistake the three staminodial segments that project out of the perianth cup for the corolla. perianth thus construed would consist of two whorls with the inner segments often shorter than the outer ones. assumption has at least equal merits with Beccari's in which it is supposed that Blanco, through a slip, inverted the description of the calvx and the corolla. According to my interpretation, C. usitatus Blco. is a true Calamus and not a Daemonorops.

I therefore regard C. usitatus Blco. as a legitimate name for a plant described by Beccari under C. ramulosus. Daemonorops Rumphii Mart. and C. psicarpus Bl., with which Naves identified C. usitatus Blco. are plants which do not occur in the Philippines. As explained above, C. usitatus Blco. sensu Martius, Vidal, and Merrill is a synonym of C. Blancoi Kunth (= C. gracilis Blanco), and C. usitatus Blco. sensu Beccari is of Daemonorops mollis (Blco.) Merr. (= C. mollis Blco).

Summary

In the previous interpretations of the rattans described in Blanco's Flora de Filipinas parts of Blanco's descriptions, which are of material assistance in the identification of his species, have been left out of consideration. The chief reason for this omission was the mistaken terminology used by Blanco in framing his descriptions. I have tried in this paper to make clear the misleading portions in Blanco's descriptions, and on the basis of this I have been obliged to disagree with the three of the four identifications hitherto made and for the fourth I have found other reasons to accept the interpretation as correct than the mere use of the vernacular name. The various interpretations may be summarised under four valid names thus:—

1. Calamus Blancoi Kunth nom. nov. Enum. Pl. III (1841) 595.

TYPE SYNONYM: C. gracilis Blanco sp. nov. Fl. Filip. (1837) 267, not of Roxb.

SYN. NOV.: C. Haenkeanus Mart.; C. mollis Blanco sensu Martius (1850), Naves (1882), & Beccari (1902 & 1908); C.usitatus Blanco sensu Martius (1850), Vidal

(1883) and Merrill (1918).

PREVIOUS INTERPRETATIONS: It was regarded as identical with *C. buroensis* Mart. by Naves (1882); and with *C. brevifrons* Mart. by Beccari (1902 & 1908) and Merrill (1918 & 1922). (*C. brevifrons* Mart. acquires a new status and becomes a legitimate name).

2. Calamus maximus Blanco Fl. Filip. (1837) 266.

SYN. NOV: C. siphonospathus Mart.

PREVIOUS INTERPRETATIONS: It was regarded as identical with *C. albus* Pers. for the greater part of the description or alternately as a mixture of *C. siphonospathus* Mart. and *Daemonorops melanochaetes* Bl. by Naves (1882); with a plant which later became the type of *C. Merrillii* Becc. by Beccari (1904); *C. ornatus* var. *philippinensis* Becc. by Beccari (1905 & 1908); and *C. Merrillii* Bec. by Merrill (1918).

3. Dæmonorops mollis (Blanco) Merr. Spec. Blancoan. (1918) 86.

TYPE SYNONYM: Calamus mollis Blanco. Fl. Filip. (1837) 264; Vidal [1886, fide Beccari (1902 & 1908)] and Merrill (1918).

OTHER SYN.: C. usitatus Blanco sensu Beccari (1902 & 1908); and Daemonorops Gaudichaudii Mart.

PREVIOUS INTERPRETATIONS: It was regarded by Martius (1850) as a plant which later proved to be the male of *C. Haenkeanus Mart*. and of *C. usitatus* Blanco *sensu* Martius (1850), Vidal (1883) and Merrill (1918); *C. Haenkeanus* Mart. by Naves (1882) and Beccari (1902 & 1908). (These binomials are regarded here as the synonyms of *C. Blancoi* Kunth.).

4. Calamus usitatus Blanco Fl. Filip. (1837) 265.

SYN. NOV.: C. ramulosus Beccari.

PREVIOUS IDENTIFICATIONS: It was identified by Martius (1850) with a plant which later proved to be the female of the species identified by him as C. usitatus Blanco and therefore identical with C. Haenkeanus Mart.; with C. psicarpus Bl. and Daemonorops Rumphii Mart. by Naves (1882); with a plant identical with C. Haenkeanus Mart. by Vidal (1883) and by Merrill (1918); Daemonorops Gaudichaudii Mart. by Beccari (1902; 1908, 1911). [Beccari's C. usitatus Blanco is C. mollis Blanco (= Daemonorops mollis Merr.) and C. usitatus Blco. sensu Vidal and Merrill is C. Blancoi Kunth as here interpreted].

Conclusions

The present inquiry into the rattans described by Blanco shows the inadvisability of accepting as decisive interpretations of long-forgotten and dubious species, when such interpretations are based principally on the vernacular names and the economic uses mentioned by their authors.

It is an accepted principle in the taxonomy of plants that, in the interpretation of old and inadequately described species the types of which are not extant, considerations on plant geography should be our most important guide. if such considerations combined with the original botanical descriptions do not help one to identify a given species or to reject a given interpretation of a species, it should be, in my opinion, illegal to revive a specific name or to reject an accepted interpretation on the basis of the application of the vernacular names by indigenous peoples or on the economic uses of the species, even though these names and uses formed a part of the orginal specific descriptions. Such interpretations may show the probability of the species intended by the author and supply a clue to the ultimate identification of the species on a scientific basis, but they cannot be accepted as decisive. So also changes in the current nomenclature of the species should be invalid when based on the study of the vernacular names and the economic uses of the plant mentioned in the description of the species. if unaccompanied by botanical reasons.

The need for such prohibitions is obvious. A plantcollector or a field-botanist usually depends on native helpers for his information on such particulars and one cannot be sure that these helpers are expert in recognising the plants, or whether or not the information supplied is applicable to more than one species. In the case of plants which are entirely cultivated and do not exist in a wild state the case may perhaps be somewhat different; but it is better in the interest of stability in the nomenclature of plants to discourage even here the revival of long forgotten or dubious binomials on such grounds. If such provision be not made, then several hundreds of unidentifiable species could be resurrected entirely on the study of their vernacular names and even then one could pick out flaws and give a different interpretation on somewhat similar data collected by other persons, permitting thereby the rejection of well-known and well described binomials without any necessity or proper reason, and contributing to the instability of the nomenclature of the plants—a frequent cause of objection by horticulturists and foresters against the rule of priority.

Further if the principle of reviving old binomials on the basis of vernacular names and economic uses mentioned by their authors, or rejecting on such grounds earlier interpretations based on systematic characters is admitted, it means that the information recorded on these subjects (vernacular names and economic uses) is at least of equal value and importance as the systematic descriptions in validating the publication of a species and that one could on this principle validly publish a species merely by mentioning under a proposed binomial its vernacular names and its economic uses. Systematic botanists would then depend on philologists, economic botanists, historians, etc. for the accurate interpretation of a species.

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* PALMÆ MALESICÆ

V.-Notes on Some Malayan Dæmonorops

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This paper embodies the notes I have made on some doubtful, rare, imperfectly known, or new species of Daemonorops of the section PIPTOSPATHAE represented in the Singapore and the Kepong* herbaria. The following seven are described as new species or varieties: (a) **D. bra**chystachys, D. Kunstleri var. langkawiensis and D. pseudomirabilis var. malayanus from the Malay Peninsula; (b) **D. calothyrsus** and **D. longipedunculatus** from Borneo; (c) D. lasiospathus from the Malay Peninsula and Borneo; and (d) **D. confusus** from Sumatra. Owing to the scanty material available of D. propinguus from the Peninsula, Beccari based his specific description on more than one specimen. It is shown that not all the specimens utilised in the description belong to this species, and that Ridley had at one time included under D. propinguus specimens belonging to D. leptopus (cf. synonymy and remarks under D. brachystachys, D. confusus, D. micracanthus and D. didymophyllus). D. propinguus, as defined here, is purely a peninsular species; the Sumatran material referred to this species is apparently **D. confusus.** As a result of good herbarium specimens collected by the personnel of the Forest Research Institute, Kepong, I have been able to reduce D. draconcellus to D. micracanthus, thereby extending the range of the latter to Borneo. Apparently this is the species that produces the best "Dragon-Blood" of commerce both in the Peninsula as well as in Borneo. Of the four peninsular species belonging to the sub-section RESINIFERAE, D. brachystachys appears to be the most scarce, while D. micracanthus and D. didymophyllus the most frequent. The lastmentioned was regarded as endemic in the Peninsula, but it is shown here to occur also in Borneo. It was confused by Merrill with D. periacanthus Miq., a non-resiniferous species. The Bornean species D. sparsiflorus and its var.

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^{*} I am indebted to the Director of the Forest Research Institute, Kepong, Malay Peninsula, for the loan of the material.

sarawakensis do not belong to the RESINIFERAE, among which it was placed by Beccari. D. verticillaris is shown to be a species endemic in the Peninsula, previous records for its occurrence in Borneo being based apparently on misindentified specimens of **D. acamptostachys,** a species that appears to be very akin to D. floridus. What appears to be D. annulatus—a species hitherto known only from Borneo has been found to be abundant along the banks of Sungei Kavu Ara in Johore, but both the Bornean and the Peninsular material so far collected lack reproductive parts to enable one to decide the status or the affinities of the The typical D. elongatus (a Bornean species) has not been found in the Peninsula, all the peninsular specimens that were previously referred to this being either D. Kunstleri or its var. langkawiensis. The latter is a very variable species with regard to the number of longitudinal rows into which the scales are arranged on the fruits. A similar variation is also noticed in **D. vagans**, which is possibly a senile form of D. Kunstleri. It is shown that Ridley's record for D. scapigerus in the Peninsula is erroneous, though a species very like it occurs both in Borneo and the Peninsula (D. lasiospathus). A form of D. longipes occurs in Borneo (see my remarks under D. longipedunculatus). There is a great deal of variation in this species (D. longipes) and so it appears to me that a thorough revision of all the species belonging to its group is badly needed in order to see whether the various forms akin to it should be separated as distinct species or lumped together under D. longipes as mere ecologic or varietal forms. For a thorough revision of this group, a series of material specially from the Liu Kiu Islands, Borneo, Bangka, Philippines, etc. wil be needed. A similar revision is also due of the group represented by D, elongatus and D. Kunstleri as well as of the one represented by D. oblongus, D. Korthaslii and D. hystrix. I have shown here that it is advisable to keep **D.** oligophyllus separate from *D.* sabut (to which Ridley had reduced the former) until fertile material is found. At present the two species are known from the infertile material only and one notices important distinctions between these two. That they appear to be closely related was noticed by their author himself (Beccari, l.c. 1911, p. 181–183). **D. ruptilis** which was described from a specimen collected by Low in an unknown place in Borneo has been found again by Elmer at Tawao in British North Borneo. D. setigerus is shown to be an illegal* binomial based on a mixture of specimens belonging to more than one species.

As said above, all the species treated in this paper belong to the section PIPTOSPATHAE as defined by Beccari in the Annals of the Royal Botanic Gardens, Calcutta (cited hereafter as Calcutta Annals or merely Calc. Ann.) XII, I am not sure that the two sections. CYMBOSPATHAE and PIPTOSPATHAE, into which Beccari has divided the genus are very natural; for the specimens of the first section having a long peduncle (e.g. D. imbellis and D. Scortechinii) are separated with difficulty from the species of the second section having a very much abbreviated fertile part (e.g. D. lasiospathus, D. scapigerus and D. brachystachys). Further Beccari has subdivided the section PIPTOSPATHÆ in a way that the species like D. geniculatus and D. verticillaris, which have a long external spathe enclosing, before anthesis, the entire inflorescence including the subprimary spathes, are placed very far apart from the ones which have similar outermost "universal" spathes simply because these latter are not provided with annular rings or collars on their leaf-sheaths (e.g. D. Sarasinorum). Further, these species having the "universal" spathes much longer than the internal ones resemble in their spathe characters some of those now placed under CYMBOSPATHÆ (e.g. D. melanochaetes and D. Jenkinsianus). By drawing the attention of readers to these facts I do not wish it to be understood that I am in disagreement with the sections and the subsections into which the genus Daemonorops has been divided. Beccari had to do the best with the scanty material placed at his disposal by the various herbaria to which he

^{*} I use the word illegal on purpose; for the name is valid in the sense that it will have to be listed in such books as Index Kewensis and that its publication has once for all prevented making its legal use for any other species. (e.g. A homonym is a valid binomial, though illegal). An invalid name, on the other hand, is such that no botanist need take any notice of it and does not preclude one from making valid and legal use of it for a new species. (In this category come all nomina nuda and all binomials that after 1935 are published without any diagnosis in Latin. They should not be listed in Index Kewensis). Now the question comes whether one could legally use the trivial name of a valid, but illegal, binomial in a new combination when the binomial is the oldest validly published name for a species, and when the new combination does not produce either a new homonym or a duplication of the generic name? Formerly strict supporters of the priority rule adopted the trivial names of a homonym if the latter was the oldest valid name for the species, but, nowadays owing to a tendency of confusing legality of a binomial with its validity, there are botanists who strongly object to the use of trivial names of valid homonyms in making new combination, whether the homonyms have a priority claim or not. There is therefore a need for definite legislative measures to make this point quite clear and not a matter for individual opinion.

had appealed for specimens, and great credit is due him for restoring order where previously there was nothing but chaos and confusion. But as said in my previous paper (Gard. Bull. VIII, p. 242–243) there is a great need for making more perfect specimens than the ones previously made, and it is to prove the necessity of this that I have pointed out what appear to be flaws in the sections and the subsections of the genus Daemonorops, since it is only a study based on a series of good specimens that can throw further light on this matter. In addition to the usual parts. it is absolutely necessary that collectors make it a point to include in the specimens of Daemonorops the leaf-sheath (possibly the entire sheath when it is armed with annular rings) and the outermost spathe which falls off easily at the time of anthesis of the inflorescence. Should forest departments depute properly instructed collectors to the places where coupes are being felled or openings are being made in a forest for the purpose of road-construction or of extraction of certain commercial timbers, much valuable material can be collected which otherwise is obtained with great difficulty; for the long climbing rattans usually flower and fruit when they reach the tops of tall trees, and in a thick forest it is often not possible to bring down a rattan without felling several trees.

1. Dæmonorops acamptostachys Becc. in Calc. Ann. XII (1911) 209 pl. 96.

D. verticillaris Mart. sensu Ridl. Mat. Fl. Malay. Pen. II (1907) 186 et Fl. Malay. Penin. V (1925) 45 quoad specimina borneensia; Merr. Bibliogr. Enum. Bornean Pl. (1921) 82 syn. nov..

BORNEO: **female**: Matang (Ridley, 12395, the Type); Kuching (Ridley, 12409; Shelford, vern. name *Daun Wi*). **Male**: Sarawak (Shelford, male and female mounted on the same sheet); Kuching (Hewitt; Sahib).

The species appears to be erect or semi-scandent, for, though the leaf-rachis bears strong, stout digitate claws on the dorsal side, the cirrus is small or rudimentary. Ridley's n. 12409 is accompanied by a petiole of a radical leaf which indicates that this rattan is tufted. The petiole is fugaceously furfuraceous and armed along the margins with long solitary or digitate spines. The primary spathes are narrowly lanceolate-cymbiform, acuminate, unicarinate, covered with deciduous rusty scurf on the outside, the lower spathes being scantily armed along the carina with solitary, distant, slender spines. The male flowers are pectinate as in D. geniculatus and D. verticillaris, a probable reason why Ridley confused this species with D. verticillaris and extended the distribution of the latter from the Malay

Peninsula to Borneo. The fruiting perianth is explanate but it withers away gradually until a small callosity (1–2 mm. long) remains on the fruit. The fruit scales are arranged in 15 vertical rows.

In the female flowers of one spadix in a duplicate of the type preserved in the Singapore Herbarium (Ridley 12395), the spathels are unusually enlarged so as to obscure the length of involucrophores. But another spadix from the same collection and the one collected by Shelford both show that this enlargement of the spathels is not normal and that the involucrophore could be much longer than hitherto described. This fact and the close resemblance of the leaflets of D. acamptostachys to those of D. floridus incline me to suspect that the latter species may be conspecific with the former. No doubt in D. floridus the leaflets are described as being grouped, but Beccari stated this after seeing only a terminal portion of a leaf. It is a known fact that in many leaves which have equidistant or subequidistant leaflets, but which end in a long cirrus, the leaflets become so disarranged in the terminal parts of the leaves as to give a mistaken impression that they are also so arranged in the lower parts of the lamina; and the terminal portions of the leaves of D. acamptostachys there is also a tendency for the leaflets to become disarranged. The only thing that makes one want to see more specimens of these two species before coming to a definite conclusion over the status of D. floridus is that its spadix is unusually long and that its leaves have a rather long cirrus.

2. Dæmonorops annulatus Becc. in Rec. Bot. Surv. Ind. II (1902) 227 et in Calc. Ann. XII (1911) 174 pl. 72.

MALAY PENINSULA: Johore, Sungei Kayu Ara, at 12½ mile Mawai-Jemaluang Road (Corner & Furtado, 29485; & 29486).

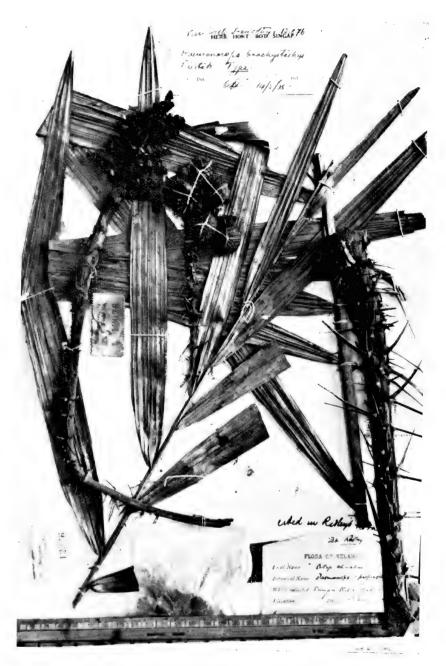
The above cited specimens (both taken from the same tuft to show the difference in the armature of the leaf sheaths of its juvenile and adult forms) appear to belong here, though the species has never been recorded before in the Peninsula, the type having been collected in Borneo. The younger stages are provided with long criniform bristles on the annular crests and resemble very much D. mirabilis var. oligocyclis Becc., a variety described from a specimen cultivated in Buitenzorg Botanical Gardens. The species grows in tufts and is very frequent in the dense forests along the Sungei Kayu Ara, though not a single plant was noticed with flowers or fruits.

3. Dæmonorops brachystachys Furtado spec. nov.

D. propinguus Becc. in Hook, f. Fl. Brit. Ind. VI (1893) 467 quoad fructus ac foliola in nota (?); Ridl. Mat. Fl. Malay Pen. II (1907) 181 quoad specimen a Wrayio sub n. 3658 lectum, et Fl. Mal. Pen. V (1925) 41 quoad specimen kelantanense infra citatum. Plate 37.

Caudex scandens vel semi-scandens, robustus. dium vagina partim tantum visa, modo petioli armata ut Petiolus (frondium radicalium?) elongatus, 20 cm. superans, aculeis magnitudine variabilibus præditus; maximis ad 7 cm. longis, basi 4 mm. latis, apice acutis, subulatis, minimis 1 cm. longis vel interdum brevioribus, inter alteros sitis, deciduis (?), criniformibus; omnibus solitariis, perraro basi confluentibus. Lamina in cirrhum brevem vel rudimentarium terminata. secus rhacheos dorsum unguibus 1-3-fidis reflexis armata. Segmenta numerosa, inæguidistantia, alternantia vel sub-opposita, 4 cm. vel ultra inter se dissita, elliptico-lanceolata, sæpe apicem quam basin versus magis attenuata, maxime latitudine ad mediam vel infra sita, apice subito acuminata, subulata, basi abrupte contracta, plicatula, supra secus tres costas prominentissimas et subtus ad costam mediam remote spinulosa, 35-60 cm. longa, 3-5 cm. lata. Spadix foemineus: pedunculo ancipite 10-25 cm. longo, ad 1 cm. lato, 0.5 cm. crasso, secus margines et in latere superiore applanato aculeis digitatis vel non, ad 2 cm. longis valde armato, in latere inferiore convexo parcissime armato vel non: parte rhacheos terminali fructifera circ. 5-8 cm. longa; basali infertili ad 8 cm. longa; ambobus rhacheos partibus conjuncte pedunculo fere æquilongis vel brevioribus. primarii 2, spiculiferi, spiculis ad 3 cm. longis, fructus ad gerentibus. Spathae primariæ ignotæ: spathellæ annulares, apice in ligulam triangularem productæ. Involucrophorum breve, ex spathellis paulo exsertum; involucrum obconicum, in cratera illius fere omnino immersum, apice prateriforme; areola latitudine sua æquilonga vel brevior. Perianthium fructiferum explanatum. Fructus oblongoellipticus, utrinque attenuatus, sine mucrone apicali ad 2 mm. alto et 3-fido 2.5 cm. longus, 1.8-2 cm. in diam., maxima latitudine ad mediam vel fere sita. Squamae secus mediam canaliculate, per orthostichos 18-20 disposite, resina atrosanguinolenta profuse vernicatæ. Semen ovoideum, 1.5 cm. 1.3 cm. latum, 1.2 cm. crassum.

Planta mascula habitu sicut fæminea ut videtur. Spadix masculus: rhachis fertilis tantum visa, 40 cm. longa,



Dæmonorops brachystachys Furtado. Type.



in ramos 9, ad 7 cm. longos divisa; rami secundarii plures, graciles, spiculas numerosas gerentes; spicularum axis ramis secundariis similis, gracilior. *Corolla* 4 mm. longa, striata, calyce multototies longior.

MALAY PENINSULA: **Female**: Kelantan: Sungei Keteh at Batu Papan (Nur with Foxworthy, 12076, vern. name Atap Chuchur. Type in Singapore). Perak, Upper Perak at 300 feet alt. (Wray, 3658). **Male**: Selangor: Semenyih (Hume, 8113).

Leaflets in Wray's specimens are apparently from radical leaves.

This species appears to be related to D. draco as interpreted by Beccari in that the leaflets have three nerves bristly in the upper surface (the midrib only in its terminal portion) and the fruits are somewhat elliptic pyriform. The leaf-sheath and the petiole described above appear to belong to the basal leaves and hence are not comparable in any way to the corresponding parts of the leaves growing in the higher regions; but judging from the analogy in some other species studied by me, the normal leaf-sheath does not appear to belong to the class having deciduous, acicular spines which are one of the characteristics of The Javanese species, D. ruber, which is also described to have 3 bristly nerves in the upper surface of the leaflets differs from this in its spherical and sparingly resiniferous fruits and longer spadices. D. propinguus which has been confused with this species has ovoid fruits which are much broader towards the base and have lighter coloured scales and resin. Its leaflets has only the median costa bristly above. (See also my remarks on D. propinguus).

4. Dæmonorops calothyrsus Furtado spec. nov.

D. longipedunculato infra descripto affinissima, sed aculeis ad vaginarum apicem longioribus ac pluribus; petiolis basin versus magis armatis, aculeis frequenter longioribus; spicularum rhachi crassiore; involucrophoris longioribus crassioribusque; fructibus longioribus, pro rata angustioribus, utrinque minus rotundatis, apice longius rostratis; squamis per orthostichos 12 dispositis hæc species bene distincta.

Caudex scandens vel semi-scandens, ad 6 m. longus. Frondes longipetiolatæ, cirrhiferæ, cum petiolo cirrhoque 1.5-4 m. longæ, dorso secus rhachen unguiculatæ. Vagina haud gibosa, ut in D. longipedunculato armata sed aculeis præsertim ad apicem sæpius longioribus, ad 10 cm. longis. Segmenta per greges utrinsecus 8-12, sub-oppositos

vel alternantes, singulos ex 2–5 constatos approximata, 35–45 cm. longa, 3 cm. lata, subtus ad costam mediam remote spinulosa, supra inermia vel in quarta parte terminali ad eamdem costam remotius aculeolata, secus margines spinulosa, venulis tranversis conspicuis. Spadix foemineus (sine pedunculo?) 40–50 cm. longus; pedunculo ancipiti; ramis primariis 3–5, spiculiferis, 15–18 cm. longis; spiculis axi sinuosis, ad 8 cm. longis, tomentosis flores utrinsecus 5–6 gerentibus. Involucrophorum floriferum ad 2–4 mm. longum; fructiferum 5–7 mm. longum, cum involucro perianthioque 10 mm. longum. Fructus cum perianthio cyathiforme-campanulato 2–3 mm. et rostello 2.5–4 mm. alto 26–28 mm. longus, 12–13 mm. in diam; squamis per orthostichos 12 loricatis. Semen 16 mm. altum, 8–9 mm. latum, 7–8 mm. crassum; embryone subbasilari.

Spadix masculus paniculatus, decidue fusco-furfuraceus; pedunculo longo, ancipiti. Spathae primariæ papyraceæ, exsuccæ, cinnamomeæ, extus furfureo fugaceo fuscæ, inermes; externa longissima, acuminata, bicarinata; spathellæ annulares. Rami: primarii circ. 20 cm. longi; secundarii 6–7 cm. longi, spiculiferi; Spiculae 2–4 cm. longæ, axi sinuosæ, floribus untrinsecus 3–6.

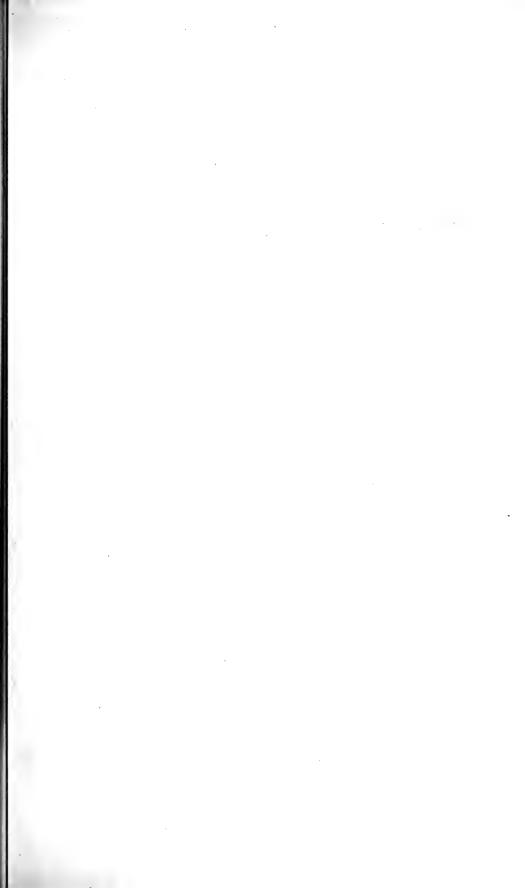
BRITISH NORTH BORNEO: Kinabalu Mountains at Tenompok, alt. 4,000-5,000 feet (legit Furtado, comm. Clemens sub. n. 29194, female, Type in Singapore; and n. 29193, male).

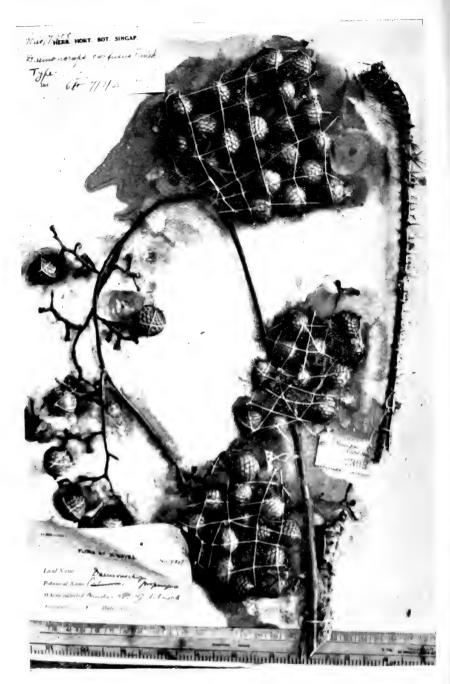
Found growing in secondary jungle. My field notes say that the spadix is 40-50 cm. long, but I am not sure whether the peduncle was included in the measurements.

The species is at once distinguished from all the others belonging to *D. longipes* group by its fruits, which are, even in their younger stages, long and narrow, having their fruit-scales in 12 rows. The leaflets are almost bare above except for a small terminal portion which is spinulose along the midrib.

D. sabensis (collected in the lower regions of the Kinabalu Mountains) which from the description appears to belong also to this group, is said to have a very short petiole and a male inflorescence with funnel-shaped spathels and with the male flowers arranged as in D. longispathus and not as in D. longipes. The leaflets are described to be sparingly armed along the three nerves beneath. (The female plant is unknown).

From D. periacanthus it is easily distinguished by its unarmed (or occasionally sparingly armed) peduncle, fruits which are nearly twice as long as broad (not spherical),





Dæmonorops confusus Furtado. Type.

fruit-scales arranged in 12 (not 15–16) vertical series, by its leaf-sheaths which show no gibbosity below the petiole and which have very few small laminar or criniform bristles, and by its leaflets which have a midrib usually armed for the greater part in the lower, and only a small terminal portion in the upper, surface.

5. Dæmonorops confusus Furtado spec. nov.

D. propinquus Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et in Calc. Ann. XII (1911) 111 quoad specimen sumatrense a Forbesio lectum et in Tabula 45 depictum?

D. draco Willd. sensu Bl. Rumphia (1845) quoad tab. 132? Plate 38.

Caudex scandens, robustus, cum vagina 2.5-3.5 cm. in diam. ut videtur. Frondis vagina infra petiolum gibbosa, aculeis inæquialtis: longissimis paucis, robustis, ad 3 cm. longis, elasticis, plus minusve deflexis, laminaribus, sæpe laciniatis, plerumque solitariis, e basi latis apicem versus angustatis, summo subulatis; alteris multototies brevioribus, consimilibus, plurimis, inter priores positis, solitariis vel interdum confluentibus armatissima. *Petiolus* supra applanatus, aculeis ad 1.5 cm. longis, solitariis vel basin versus transverse confluentibus armatus, subtus convexus, aculeis paucioribus plerumque solitariis. Lamina magna. cirrhum longum unguibus ad 7-fidis armatum transiens; ad rhacheos dorsum unguibus 1-3-fidis, reflexis prædita, supra parce aculeolata. Segmenta numerosa, subæquidistantia, alternantia vel subopposita, in parte terminali in greges ex segmentis binis vel pluribus sæpe approximata, plicatula, elliptico-lanceolata, utringue subito attenuata, secus costam mediam utringue parce aculeolata, subtus pallidiora, secus margines spinulosa, apice longe acuta vel acuminata, setosa, venis transversis indistinctis, 2-3.5, interdum 5.5 cm. inter se dissita, 25-35 cm. longa, 2 cm. Spadix foemineus fructiferus tantum visus, cum pedunculo ancipiti 5 cm. longo secus margines armato 50 cm. Spathae primariae ignotæ, spathellis perbrevibus annularibus apice liguliformibus. Rami primarii circ. 5, in spiculas alternantes ad 5 cm. longas divisi. Involucrophorum tri- vel quadrangulare, pedicelliforme, clavatum, 1 cm. longum. Involucrum 2-4 mm. longum, obconicum, apice truncatum ad 5 mm. in diam., vertice concavum; areola oblonga involucrophoro fere æquilonga. Perianthium fructiferum explanatum. Fructus oblongus, longe mucronulatus, sine mucrone 2–3 mm. alto circ. 20–22 mm. longus, 17-19 mm. in diam., squamis secus mediam canaliculatis. per series verticales 18-20 imbricatis, resina atro-purpurea vernicosis. Semen ovoideum, profunde ruminatum, 1.3 mm. longum, 1.2 mm. in diam.; embryone basilari.

SUMATRA: Bandar Baru on Gunong Sibayak (Nur 7308. Type in Singapore).

The photographic plate 45 in the Calcutta Annals XII represents a Sumatran plant collected by Forbes under n. 2287 and preserved in the Calcutta herbarium. Beccari has identified it as D. propinguus, from which it differs in several characters: for, to quote from my notes made of the duplicate preserved at Kew, the leaflets in it may be described as elliptic lanceolate, while in D. propinguus they are much longer (40-45 cm.), broader (2-3.5 cm.). ensiform, gradually narrowing towards the apex. involucrophore in Forbes's specimen is much longer than in the type of D. propinquus. The outer spathe shows slender spines, solitary or in groups, mostly along the two dorsal carinæ and margins, without any tendency to align themselves in transverse series, though they may be linked vertically by the fibres of the carinæ and the margins. In Griffith's specimen referred here to D. propinguus the outer spathe is much more rigid and woody and has not any prominent dorsal carinæ. Its spines too are often transversely digitate and coalesce sometimes to form interrupted horizontal series.

Forbes's specimen appears to belong to *D. confusus*, though owing to a great difference in the development between its spadix and that of the type of *D. confusus*, and also owing to the absence of the outer spathe in the latter, I cannot be sure of the determination. The leaflets and the armature on the petiole and the sheath agree very well with those in Nur's specimen. I did not have the latter with me at the time I made notes of Forbes's specimen, but looking at Beccari's plate, I note that the peduncle in that of Forbes is armed all round and with more spines, whereas in Nur's it is (very sparingly) armed only along the two margins. But such variations may sometimes be found even in one and the same species.

Blume's plate 132 in Rumphia (1845) appears to belong here, though Beccari (op. cit. p. 107) was inclined to regard it as the real D. draco (Willd.) Bl. According to Beccari's interpretation I take D. draco to be a species with small seriate bristles on the sheath (more or less as in D. dracunculus Ridl.) and short involucrophores (as in D. propinguus). Blume's plate 132 does not in any way satisfy these two conditions. The armature on the outer spathe in the plate appears moreover to be like the one in Forbes's specimen preserved in the Kew Herbarium.

Dæmonorops didymophyllus Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 468 et Calc. Ann. XII (1911) 123;
 Ridley in Journ. Roy. Asiat. Soc. Str. Br. (1900) 175,
 Mat. Fl. Mal. Pen. II (1907) 180 et Fl. Mal. Pen. V (1925) 41.

D. periacanthus Miq. sensu Merr. in Univ. Calif. Publ. Bot. XV (1929) 24 syn. nov.

Malay Peninsula: Singapore: Selitar (Ridley: in 1890; in 1892, vern. name Rotang Udang; in 1894 n. 6277); Chan Chu Kang (Ridley, 3476, v.n. R. Udang); Bukit Timah (Ridley: in 1892, v.n. R. Butong. "The poisonous rattan, used by the Sakais"; in 1895, v.n. R. Getah; and 5875 and 6672); Changi (Ridley 6273; Mat in 1894); Bukit Mandai (Ridley, 10437). Johore: Pulau Tinggi (Burkill, 928, v.n. R. Tawa); Sungei Pelapa (Nur, 20045); Gunong Banang (Ridley in Nov. 1900); Mt. Austin (Ridley in June 1904); Tanjong Kopang (Ridley, 6285). Selangor: Bukit Enggang (Symington, 24207, vern. n. R. Kambong); Kepong Plantations (Junas, 16403, vern. n. R. Mantang); Rawang (Ridley, 7885, vern. n. R. Tahi Ayam). Pahang: Tembeling (Henderson, 24532). Kelantan: Sungei Keteh at Batu Panjang (Nur with Foxworthy, 12113, v.n. R. Saga); Perak: Taiping Hills (Ridley in Feb. 1904); Maxwells Hill (Burkill & Haniff, 12681); Tapah (Burkill & Haniff, 13450); Jor (Haniff, 14231, Sakai name is Gum Chebor). Penang, Penang Hill (Ridley, 10345).

BORNEO: Tawao (Elmer 20482); Quop (Hewitt, in March 1908); Matang (Ridley in 1903, and n. 11823); Puah (Ridley, 12408).

In his Flora, Ridley has referred to D. propinquus Becc. the specimen collected by Burkill and Haniff at Tapah under n. 13450. Merrill op. cit. has referred Elmer's specimen to D. periacanthus Miq. with a proviso that it does not agree "particularly well" with Beccari's plates 88–89 given in the Calcutta Annals and that it "may prove to represent a distinct species". The Bornean specimens collected by Hewitt and Ridley show a great deal of variation from the type, but in the absence of better material I am averse to separate them into varieties. These variations incline me to regard D. Motleyi Becc. as a mere variety of D. didymophyllus.

 Dæmonorops Kunstleri Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 469 et Calc. Ann. XII (1911) 151, t. 61; Ridl. Fl. Malay Pen. V (1925) 43.

D. elongatus Bl. sensu Ridl. Mat. Fl. Malay. Pen. II (1907) 185, in Journ. Roy. Asiat. Soc. Str. Br. 59 (1911) 215 et Fl. Mal. Pen. V (1925) 43. syn. nov.

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MALAY PENINSULA: (a) Fruit scales arranged in 15 vertical series: Pahang, Sempadam, near Gap (Burn-Murdoch, 13297); Fraser's Hill (Holttum, 21526). Selangor, Bukit Kutu (Ridley in May 1896); Semangok (Ridley in Aug. 1904); Kwang (Ridley, 13451). Negri Sembilan, Bukit Tangga (Nur, 11853); Gunong Angsi (Nur, 11671). Johore, Temeoh River near Kota Tinggi (Ridley, 15361); Gunong Bechua (Holttum, 10839).

- (b) Scales in 15-17 series. Kedah, Gunong Jerai = Kedah Peak (Ridley in June 1893). Penang, Penang Hill (Ridley, 10343); Balik Pulau (Ridley, 7905). Johore, Kuala Tebrau (Mat in June 1892); Gunong Belumut (Holttum, 10610; & 10748?); Kluang (Holttum, 9257). Singapore, Chan Chu Kang (Ridley in Oct. 1889); Bukit Mandai (Ridley in 1909); Bukit Timah (flrs., Ridley in 1894).
- (c) Fruit scales in 16-18 series. Penang, Government Hill (Curtis, 2150); Mount Elvira (Haniff in April 1901). Perak, Larut Hills (Ridley in Dec. 1902). Pahang, Wray's Camp in Tahan (Ridley, 16291). Dindings, Bruas (Curtis Dec. 1903, v.n. Rotan Dudok). Johore, Mount Austen (Ridley in 1909). Singapore, Chan Chu Kang (Goodenough, 1667*); N. Seletar (Ridley in Dec. in 1890).

From the above classification of the specimens it will be readily seen that the species is very variable regarding the number of vertical rows into which the scales are arranged on the fruits.

Possibly this and *D. vagans* represent varieties of *D. elongatus* Bl., but the typical form of *D. elongatus* does not occur in the Malay Peninsula. Ridley's specimen n. 7905 collected at Balik Pulau in Penang was doubtfully referred by Beccari (*l.c. 1911. p. 141*) to *D. elongatus* and was said to have fruit-scales arranged in 18 vertical rows. A duplicate in the Singapore herbarium has its fruit-scales arranged only in 15–16 orthostichies. The lowermost spathe is also much smaller than in the typical *D. elongatus* and is like that of the typical *D. Kunstleri* though the leaflets are inequidistant in the terminal portion of the leaf; but this condition, I believe, is due to the fact that the cirrus is well developed as it often happens in many specimens of *D. Kunstleri*.

7A. Var. langkawiensis Furtado var. nov.

D. elongatus Bl. sensu Ridl. in Journ. Roy. Asiat. Soc. Str. Br. 59 (1911) 215; Ridl. Fl. Mal. Pen. V (1925) 43 quoad specimen ab Haniffio lectum.

^{*} This number is also given to a specimen collected by Goodenough at Kranji. The spadix of this latter specimen is of D. hystrix.

A forma typica differt foliolis remotioribus, fructus squamis per orthostichos 20 dispositis.

MALAY PENINSULA: Langkawi Island, Gunong Raya (Haniff & Nur, 7119); Kesap (Haniff, 15911, v.n. Rotan Jeren); Burau (Ridley, 15884). On the last mentioned specimen is also mounted a spadix of *D. hystrix*.

8. Dæmonorops lasiospathus Furtado spec. nov.

D. scapigerus Becc. sensu Ridl. Flor. Malay. Pen. V (1925) 43 p.p. ?.

Caudex erectus, 0.5-1.5 m. altus, solitarius. Frondium vagina apice oblique truncata, haud gibbosa, fugaceoleprosa, spinis applanatis gramineis, per series subparallelas obliquas confluentibus, 1-2.5 cm. longis armata. Petiolus 35-40 cm. longus, 8-12 mm. latus primum fusco-leprosus, dein glabrus, gramineus, supra applanatus basin versus late canaliculatus; dorso convexus; ad margines obtusas spinis ad 6 cm. longis, gramineis, applanatis, plerumque ternatis (digitis divaricatis, duobus dorsum versus enatis quam tertio multo brevioribus) armatus. Lamina metralis, plerumque cirrho carens vel in cirrhum filiformem ad 6 cm. longum terminata, unguibus simplicibus vel bifidis per series duas ad margines rhacheos dorsales prædita, in parte apicale sæpe carentibus. Segmenta plura, equidistantia, 2-3 cm. inter se remota, ensiformia vel lanceolato-lineraria, 25-30 cm. longa, 18-20 mm. lata, utrinque attenuata, in acumen longum oblique contracta, ad margines spinulosa, spinis apicem versus valde confertis; supra conspicue 3-costulata, viridia, secus costam mediam apicem versus tantum remote spinulosa, costis ceteris inermibus; subtus pallidiora, 5-leptoneura, ad totam costam medianam setulis inter se 2-4 mm. dissitis, ad costas ceteras setulis inter se 5-10 mm. vel magis remotis conspicue armata. Spadices foeminei: pedunculus magnitudine variabilis, 30-55 cm. longus, applanatus, biconvexus vel obscure triangularis, indumento ferrugineo deciduo obtectus, rarissime inermis, plerumque aculeis ad 2.5 cm. longis, solitariis vel digitatis, acicularibus vel applanatis, basin versus longioribus ac sparsioribus, superne minoribus ac magis confertis, interdum basi confluentibus armatus; pars florifera 5-15 cm. longa, in 3-5 ramos primarios floriferos vel spiculigeros, ad 5 cm. longos, indumento ferrugineo deciduo obtectos divisa. Spiculae 10-15 mm. longæ, floribus 3-5 confertis. Sapathae: primariae membranaceæ, exsuccosæ, scaphoideæ, ad 15 cm. longæ, post anthesin deciduæ, trichomis sericanis, ad 2 cm. longis, herbaceis, plus minusve appressis, per series transversales dispositis præditæ, inter quas indumento ferrugineo deciduo obtectæ; secundariae circ. 1 cm. longæ, inermes, fugaceo tomentosæ, membranaceæ, basi amplectantes, apice acuminatissimæ. Spathellae annulares, oblique truncatæ vel in uno latere in ligulam triangularem productæ, basi tomen-Involucrophorum sessile, cupuliforme, in spathella Involucrum consimile. immersum vel paululo exsertum. Flores 1 cm. longi; calyx 5 mm. longus, profunde tripartitus; corolla calyce duplo longior, fere ad basin tripartita, segmentis lanceolato triangularibus, coriaceis. Perianthium fructiferum explanatum, apice mox emoriens, Fructus sphærici vel basi 2–4 mm. longum, callosum. globosi, 2.5 cm. in diam., in apiculum conicum ad 4 mm. longum abrupte terminati, squamis per series verticales 13-15 dispositis, basi gramineis, apicem versus atro-fuscis, secus margines conspicue atro-cinctis, dorso sulcatis. Semen cum integumento sicco ambitu oblongum, 17-19 mm. altum, 16-17 mm. crassum, utringue truncatum, basi caudiculatum; sine integumento globoso ovoideum, obscure quadrangulare, 17-18 mm. altum, 15-17 mm. latum, 15-16 mm. crassum, basi rotundato-truncatum, apice paulo atttenuatum, summo rotundatum. Albumen profunde ruminatum; parte centrale homogenea et alba circ. 5 mm. in diam. Embryo basilaris.

Planta mascula habitu ut fœminea, sed spadicum parte spiculigera spiculisque longioribus, pedunculo minus armato, floribus angustioribus differt. Flores 6–8 mm. longi, calyce 2–4 mm. longo, duplo breviore quam corolla.

MALAY PENINSULA: Johore, Sungei Kayu Ara, 12½ mile Mawai-Jemaluang Road, common in moist, shady forest along the river banks (Corner & Furtado, 29482-A, female plant. Type in Singapore; 29494, male plant); Ulu Kahang (Holttum, 10920).

BORNEO: Siul (Ridley, in Sept. 1905); Matang (Ridley, in July 1903 or 1905?).

This species is a very close ally of *D. scapigerus* Becc., but that is described to have spathes which are quite unarmed or smooth and leaflets which are larger and more distantly arranged on the leaf rachis and which moreover bear in their under surface bristles along the median costa only, the other ribs being quite bare. In *D. lasiospathus*, on the other hand, the primary spathes bear transverse rows of long, silky, soft herbaceous spines or hairs, and the three to five ribs, of the leaflets are conspicuously spinuliferous in the under surface.

The seeds in *D. lasiospathus* are globose-ovoid, provided with a broad superficial furrow that runs longitudinally from the base to the apex and then across the other side to the base. It is this furrow that gives the seeds an

appearance of being obscurely quadrangular. The mucilaginous coating of the seeds is rather thick when fresh and has acidulous pleasant taste. The fruit-scales vary considerably in colour; sometimes they are dark brown with a still darker line along the margins and a straw-coloured line at the base; at other times, or on other side of the same fruit, the scales are mostly yellowish or straw-coloured, the dark colour being restricted only to the apex and the margins.

I have seen only two male specimens (Corner & Furtado, 29494) and in both these the peduncles are considerably less spiny than in the female, though they do not exhibit any other character to separate them from the typical specimens. Hence I doubt the advisability in using the spininess of the peduncle as a basis for splitting the species of this group into varieties as Beccari has done in the case of *D. scapigerus* Becc. and its *var. minor* Becc. I have therefore included in the above citations Ridley's specimen (female) collected at Matang in Borneo, though its peduncle is quite unarmed.

I am not sure what specimen is referred by Ridley in his Flora to D. scapigerus Becc. The description given is mostly adapted from the one given by Beccari in the Calcutta Annals XII. The specimen is quoted thus: "Johore, Ulu Madik, (Holttum)". Now the Ulu Madik specimen is numbered 10636 and bears not the slightest resemblance to D. scapigerus, though in the Singapore herbarium it is marked to show that it is the basis for Ridley's record of D. scapigerus in the Malay Peninsula. It is a typical D. periacanthus Miq. At Ulu Kahang, a region not far distant from Ulu Madik, Holttum collected another specimen which is referred here to D. lasiospathus (cf. Holttum, 10920). Possibly Ridley had this second specimen in mind when he recorded D. scapigerus for the Peninsula.

9. Dæmonorops longipedunculatus Furtado spec. nov.

Caudex scandens vel semi-scandens, 1.5–5 m. longus, cum vagina 2.5 cm. in diam. Frondes magnae, cirrhiferae, subtus ad rhachin laminæ trigonam unguibus 3–5 fidis et ad cirrhum 5–7–fidis. Vagina in speciminibus visis haud gibbosa, allutacea, aculeis laminaribus, elasticis, solitariis vel interdum per series tranversas interruptas confluentibus olivaceis vel nigricantibus, reflexis, ad 8 cm. longis, basi 4–6 mm. latis, majoribus et brevioribus immixtis, frequenter apicem versus longissimis, inferioribus latissimis et infimis

brevissimis armata. Ochrea perbrevis, spinulis acicularibus fusco-atris per series tranversas aggregatis, ad 4 mm. longis ad marginem extus armata. Petiolus circ. 25-75 cm. longus; supra late canaliculatus vel applanatus, basin versus interdum aculeis rigidis solitariis vel confluentibus; subtus convexus, dorso aculeis solitariis rigidis, remotis; ad margines obtusus aculeis basin versus interdum laminaribus. elasticis, longioribus perpaucis, ad 5 cm, longis, brevioribus rigidis immixtis, apicem versus valde reductis armatus. Segmenta per greges approximata, gregibus alternantibus vel sub-oppositis ex segmentis 2-4 constatis, coriacea, elliptico-lanceolata, utringue sensim vel abrupte attenuata, in apicem filiformem facile emorientem terminata, basi subito contracta; 5-7 plicatulo-costulata, 30-50 cm. longa, 2.5-4.5 cm. lata, supra saturate viridia, subtus pallidiora, secus costam mediam in parte terminali utringue et remote aculeolata vel in uno latere inermia, ad margines aculeolis consimilibus sed brevioribus, apicem versus longioribus et magis confertis ciliata, venulis tranversis plurimis utrinque conspicuis. Spadix foemineus longi-pedunculatus, paniculatus: pedunculo ad 1 m. longo ancipiti, inermi vel ad margines aculeis acicularibus perpaucis remotis prædito, decidue fusco-leproso; rhachi florifera circ. 40 cm. longa, in ramos 3-5 divisa; ramis ad axillam callosis, alternis, fugaceo fusco-tomentosis, 10-20 cm. longis, utrinsecus spiculas 4-6 ferentibus; spiculis sinuosis utrinsecus 5-6 fructus gerentibus, eodemmodo tomentosis. Spathae primariæ ignotæ: spathellæ ut rhachis spicularum fuscotomentosæ. annulares. Involucrophorum fructiferum. obconicum. pedicelliforme. obscure-angulare. longum, ad axillam conspicue callosum; involucrum in involucrophoro fere omnino immersum vel ad 1 mm. exsertum, patellæforme, integrum, orbiculare vel floris latus neutri versus magis productum, vertice cicatrulla orbiculari plus minusve tumida præditum; areola conspicua, altitudine sua latiore, cicatrulla tumescente. Flores: calvx floriferus urceolatus vel cyathiformis, apice obscure trifidus; corolla calyce duplo longior, segmentis longis mox emorientibus. Perianthium frunctiferum manifesto pedicelliformme, in parte basilari cyathiforme, apice segmentis explanatis. Fructus oblongi, utringue abrupte et rotundato contracti, cum perianthio ac rostello utroque 2-3 mm. alto circ. 20-25 mm. longi, 13-15 mm. in diam. Squamae in orthostichis 15, rarius 16-17, dispositæ, medio sulcatæ, fusco-stramineæ, ad margines scariosæ, fascia intramarginali fusca vel leviter

purpurea (ad angulum inferiorem atriore) cinctæ. Semen oblongum, utrinque rotundatum, in uno latere applanatum, 15–17 mm. longum, 10–11 mm. latum, 9 mm. crassum; embryone basilari; albumine ruminato.

Planta mascula habitu sicut fœminea ut videtur. Spadix magnus et longi-pedurculatus; pedunculus anceps; rhachis ut in fœminea divisa et vestita. Rami primarii in ramos secundarios spiculas gerentes 3-4 divisi. Spathae primariae papyraceæ, exsucæ, cinnamomeæ, extus indumento fusco fugaceo obtectæ, striatæ, inermes; externa longissima, circ. 30-40 cm. longa, bicarinata, apice sæpe fissa, acuminata. Spiculae 2-5 cm. longæ, porrectæ, sinuosæ, utrinsecus floribus bifariis 4-6 congestis. Flores 5 mm. longi; calyce tubuloso, cyathiforme, striato, obscure trifido; corella striata, fere duplo longiore quam calyce, ad 2/3 in segmenta lanceolata divisa.

British North Borneo: Kinabalu Mountain Range: Penibukan, alt. 4,000-5,000 feet (Clemens: 31280, type in Singapore; 31280a; 30887; 31581; 50343; and 40754, male). Gurulau Spur, alt., circ. 5,000 feet (Clemens, 50547). Dallas, alt. 2,500-3,000 feet (Clemens: s.n. mature fruits but no leaves; 26793; 26807; 27156-a, male, no leaves; 27156; 27269).

The Dallas specimens have involucrophores distinctly longer than in the type and may prove to represent a distinct variety, but in the absence of better material I have refrained from giving them a varietal rank.

This species is very closely related to D. virescens from the Philippines and D. longipes from the Malay Peninsula and Malay Isles; but it is readily recognised from either of these by its distinctly grouped leaflets which have moreover their midribs (others are bare) sparingly spinulose in one or both surfaces, whereas in the other two species the leaflets are not distinctly grouped except perhaps in the lowermost and the uppermost part of the lamina. They (the leaflets) are also much more spinulose in the latter two species and often the side nerves (in D. longipes in the lower or both surfaces and in D. virescens in the upper surface only) also bear bristles. Perhaps D. virescens represent a link between D. longipes and D. longipedun-I have noted that the leaflets are 5-7 nerved because I do not find any difference between subprimary and secondary nerves, though in nervation these leaflets cannot be easily distinguished from those of D. longipes except by their armature.

D. periacanthus Miq. resembles this species specially with regard to the grouping of the leaflets, but it has: a much shorter peduncle which is conspicuously spiny:

spherical fruits; leaflets with a midrib usually smooth or occasionally armed with a few bristles underneath the apex only; and a leaf-sheath armed with a much larger number of smaller spines and provided with a slight gibbosity below the petiole.

Forms actually much closer to D. longipes occur in Borneo as is evidenced by Elmer's no. 20840 collected at Tawao and listed by Merrill in Univ. Calif. Publ. Bot. XV. 1929, p. 24, without any specific epithet. Judging from the fragmentary material available in the Singapore herbarium, consisting of a portion of lamina and a pair of fruiting spikelets, I am inclined to think that this Elmer's specimen represents but a mere variety of D. longipes with smaller fruits having their scales arranged in 18 vertical rows. leaflets seem to be inæquidistant and not distinctly grouped and their three costas are armed as in D. longipes with the exception that the two subprimary costas above are quite bare, a condition also found occasionally in the other species. Of the other parts which I have not seen, Merrill gives the following description: "The leaves about 3 m. long, flagellate [cirrate], the flattened spiny petiole about 1 m. in length, the spines on the basal sheathing parts flat, nearly black, 5 cm. long, arranged in transverse rows. Infructescences 45 cm. long, pendent, flattened green peduncles 60-90 cm. in length." Perhaps Merrill had no fruits and sufficient leaflets in the specimens examined by him, for he notes that "the material available for study is not sufficient for further identification".

Dæmonorops micracanthus (Griff.) Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et in Calc. Ann. XII (1911) 110 pl. 43; Ridl. Mat. Fl. Mal. Pen. II (1907) 180 et Fl. Mal. Pen. V (1925) 41 pp.

Calamus micracanthus Griff. in Calc. Journ. Nat. Hist. V (1844) 62 et Palms Brit. Ind. (1850) 72; Mart. Hist. Nat. Palm. III (1849) 339.

D. draconcellus Becc., Nelle Foreste di Borneo (1902) 324, 590, 608 et in Calc. Ann. XII (1911) 108 pl. 42; Merr. Bibliogr. Enum. Bornean Pl. (1921) 78. syn. nov.

D. propinquus Becc. sensu Ridl. Mat. Fl. Mal. Pen. II (1907) 181 et Fl. Mal. Pen. V (1925) 41 pp. syn. nov.

MALAY PENINSULA: Kemaman (Vaughan-Stevens in 1890). Kedah: Sungei Petani (Forest Dept. Coll. 10209 in herb. Kepong); Baling (Babjee, 10168 in Herb. Kepong). Pahang: Gunong Lesong (Lambak, 10006 in herb. Kepong); Sungei Lepar (Smith 6701 in herb. Kepong. Negri Sembilan: Palong Gemas (Hamid, 6380); Kuala Pilah (Moorhouse in 1904, sterile; in 1908, fertile); Bukit

Senaling (Moorhouse in 1903). *Malacca*: (Griffith, sterile, in Kew Herb. *Type*). *Johore*: Johore Lama (= Panchur) (Ridley, 10952, v.n. *Tai Ayam*, sterile). *Singapore*: Bukit Timah (Ridley in 1900, sterile).

BORNEO: Kuching at the foot of Gunong Matang (Beccari, 3644. Type of *D. draconcellus*; only its photographic plate above referred seen).

Here may also belong the following Peninsular specimens: *Selangor*: Kuala Lumpur, at Istagoh (Ridley, in June 1890). *Singapore*: Seletar, (Ridley on 30 Oct. 1889).

The basis of *D. micracanthus* was a sterile (juvenile) specimen sent to Griffith from Malacca, while that of D. draconcellus a fertile specimen collected in Borneo. But more mature and complete specimens collected in the Peninsula leave no doubt that the two species are identical. The criniform bristles on the sheath are fugacious so that in the type of D. draconcellus they have not yet fallen off. When the plants are very young, the spines grow on small tubercles, but later on, as the plants develop, the tubercles tend to coalesce in interrupted horizontal or oblique series, giving thereby a wrinkled appearance to the sheath. leaflets are often bristly in the three superior nerves, but in some cases only the midrib is sparingly armed; in the lower surface the bristles appear to be mostly deciduous so that sometimes only a few bristles remain on the midrib and at times a few are also found on the two side nerves. The perianth is explanate in the fruit with a short circular callus at the base. The fruit scales are arranged in 18-21 The spadix is covered with a deciduous vertical series. rusty brown indumentum. The very narrow leaflets, the length of the involucrophore (3-5 mm. long), the callus or perianth ring persisting on the fruits and the rusty brown indumentum on the spadices distinguish this at once from all the other "dragon-blood" producing species in the Peninsula.

Ridley's description of the fruits and spadix, which is framed in mistaken terms, was derived apparently from a specimen collected by him at Bukit Timah in Singapore, sub n. 10783, and cited by him in the Materials and his Flora. The spathe, spadix and fruits in this specimen are evidently of D. didymophyllus, while the leaf is of quite different species (possibly D. angustifolius).

The two specimens which I have doubtfully referred here and the one from Kemaman (this last consist of a fruiting spadix only) have been cited by Ridley in his works under D. propinguus. The first two specimens have leaflets which are apparently of D. micracanthus, with male

spadices resembling those of *D. brachystachys*. The only difference that one notices in the leaflets is that the lower surface of the midribs is more distantly aculeolate than in the female specimens. The spathes, though very powerfully armed, are easily distinguished from those of *D. propinquus* (as figured by Griffith) by their spines which are distinctly digitate in the latter.

With the exceptions noted above, almost all the other collectors have recorded that this species is *Rotang Jernang*—a name which Malays apply rather indiscriminately to all the species yielding "dragon-blood". This species yields perhaps the best "dragon-blood" in the Peninsula.

- 11. Dæmonorops oligophyllus Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 470 et in Calc. Ann. XII (1911) 182 pl. 78.
- D. sabut Becc. sensu Ridl. Fl. Malay Pen. V (1925) 27 tantum quoad synonym. Syn. nov.

Ridley considers the type of this species to be but a younger shoot of D. sabut. If both these binomials are conspecific, then their characters are certainly not a result of merely age but of ecological differentiations; for, apart from the distinguishing differences noticed by Beccari, it is to be noted that the leaves of D. oligophyllus, though bear smaller leaflets, are provided with much longer cirrus than in the type of D. sabut, whereas in younger forms one ought to have expected still shorter cirrus. Hence in the absence of conclusive evidences to unite the two species, I think it is better to maintain them as distinct. A specimen of what appears to be D. sabut was collected by Ridley in Johore at Castlewood in June 1909. It bears a longer cirrus than in the type specimen, but otherwise agrees well with the description and plate given by Beccari (Calc. Ann. XII, 1911, p. 181 pl. 77).

12. Dæmonorops propinquus Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 467 et Calc. Ann. XII (1911) 111 p.p. et pl. 44; Ridl., Fl. Malay Pen. II (1907) 181 et Fl. Mal. Pen. V (1925) 41 p.p.

Calamus draco Willd. sensu Griff. in Calc. Journ. Nat. Hist. V (1844) 65 p.p. et Palms Brit. Ind. (1850) 75 quoad sepecimina in pl. 201 A & B delineata.

D. draco Bl. sensu Mart. Hist. Nat. Palm. III, 2nd. Ed. (1849) 205 p.p.

MALAY PENINSULA: Malacca? (Griffith, n. 83, developed spadix in Herb. Kew, subject of Griffith's plate 201-B. lecto-Type.; Griffith, unopened spadix with spathes, subject of plate 201-A). Perak, loc. incert., (Scortechini in herb.

Beccari, not seen, figured in the plate 44). Selangor: Ayer Kuning (Omar, 9933, vern. name R. Jernang); Sungei Buloh (Omar, 9916, v.n. R. Jernang, fruits used for dyeing purposes, in Herb. Kepong). Pahang, Plangai (Burkill & Haniff, 16792, as R. Jernang, fruit eaten and medicine made from it).

Beccari's D. propinguus is a mixtum compositum. Having satisfied himself that the fruiting spadix in Scortechini's specimens belonged to the same species as the one figured by Griffith in the pl. 201. B, he wished to make its description as complete as possible. The difficulty arose when he regarded Forbes's specimen n. 2287 to be conspecific with Scortechini's; and as the leaflets in Forbes's specimen were somewhat different from those in Scortechini's, strangely enough he concluded that the leaflets in the latter specimen did not belong to the same species as the fruits, at least that is the information recorded in a note by Hooker who edited Beccari's manuscript work on the Palms in the Flora of the British India. It is possible that Hooker was mistaken in this statement, for the leaflets in Scortechini's specimen as depicted by Beccari in the plate 44 published in the Calcutta Annals has leaflets not 5 cm. broad as stated by Hooker in his note, but only 2.5-3 cm. (as in Omar's 9933) as stated by Beccari in the Calcutta Annals XII (1911) p. 112. Besides, Scortechini's collection of this species is not represented in the Kew herbarium and there is instead a specimen collected by Wray sub. n. 3658 (referred by me to D. brachystachys), which has leaflets as broad and long as the ones described in the note of Hooker and which bears a slip with information written by Dr. (later Sir) David Prain, then of the Calcutta herbarium, to state that Beccari authenticated the fruits to be exactly as in the type (?) of D. propinguus but doubted as to the leaflets belonging to same species or the plant as the fruits. This Wray's specimen is not cited in Hooker's Flora. nor in the Calcutta Annals. Ridley quoted this specimen under D. propinguus in his Materials II (1907) 181, but omitted it in the Flora (1925).

The Pahang specimen cited above consists only of a spadix with young fruits, but without its peduncle or spathes.

For the principal differences between this and D. confusus or D. brachystachys, see my observations under the latter two species. As the leaf-sheath of D. propinquus is not yet known, its exact affinities remain still doubtful. The leaflets are like those of D. gracilipes.

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The exact locality whence Griffith obtained each of the two spadices figured as C. draco in the Palms Brit. Ind. pl. 201 A & B is very doubtful. Griffith himself does not record the information on the sheets themselves, probably because C. draco, as understood by him, was widely distributed throughout the Malay Islands. But from the fact that Griffith adds to the particulars given under the habitat in Roxburgh's Flora Indica* the following: "Penang, Mr. Jarnang of the Malays of Penang", one would think that Penang was the place of origin of the spadices and that Lewis was their collector. But the words "Penang, Mr. Lewes" are deleted entirely in Griffith's second account, and instead "according to Mr. Lewis it is the" are inserted. This and the way Hooker has cited the specimens from Griffith's herbarium in the Flora suggests that only a part of them was collected by Lewis, while the other part was collected by Griffith himself or by his collector. Hooker however gives Penang as the place of origin for both these collections, while Ridley in the Materials II (1907) 182 gives Malacca and Penang.

In 1933 I had an opportunity to examine Griffith's herbarium in Kew, but as at the time the problem about the exact localities had not presented itself to me, I did not pay any special attention to search for any clues on the sheets that would help me to solve this question; but the notes I made at the time regarding the structure of the spadix and fruits state that the spadix mounted on the sheet No. 83 is the same as the one figured in the plate 201 B, but with all fruits fallen off. In the capsule mounted on this same sheet there are scales coverings and seeds of quite immature fruits mixed with some mature seeds. Obviously the scale coverings and younger seeds do not belong to the spadix which is represented in the above mentioned plate as having much larger and more mature fruits. The scale coverings are in a bad state of preservation, but still in three instances I was able to note that the scales were arranged in 13-15 orthostichies, a fact which suggests that the small fruits belong to D. didymophyllus; for this is the only dragon-blood-yielding Dacmonorops in the Peninsula having its fruit scales arranged in so few series. But the latter is never known to produce so large and so diffuse a spadix as the one depicted by Griffith; in fact the spadix on the specimen in question and the fruits depicted by Griffith agree very well with the spadix and fruits figured by Beccari in the above quoted plate 44 of D. propinguus. But as this last (D. propinguus) produces fruits having scales

^{*} The particulars recorded under the habitat in Roxburgh's Flora Indica run thus: "A native of Sumatra and the Malay Islands. Flowering time March and April."

arranged usually in 17-19 vertical series and never in less than 15, and that, unlike D. didymophyllus, it has not been found in Penang, one is inclined to suspect that the fruits on the sheet n. 83 had come from Mr. Lewis from Penang and that Griffith, or someone else, mounted them on the same sheet together with the other specimen collected by Griffith or his collector, apparently on the mistaken belief that they both belonged to one and the same species, if not to the same plant. Griffith himself had collected herbarium material in Malacca and later had maintained a collector there, and so it is not unlikely that the two specimens figured in the above quoted plates 201 A & B had come from It is true also that D. propinguus, as interpreted here, is not represented in any other herbarium collections made in Malacca Settlement, but it has been found in the neighbouring state of Selangor.

Ridley in his Flora cited under D. propinquus a specimen collected by [Nur with] Foxworthy at Batu Papan on the banks of Sungei Keteh in Kelantan; but of the two Daemonorops from this collection labelled by Ridley as D. propinquus in the Kew herbarium, one is definitely D. didymophyllus and the other represents D. brachystachys. D. propinquus Becc. sensu Ridley in Journ. Roy. Asiat. Soc. Str. Br. 33 (1900) 175 is D. leptopus Mart., at least for the greater part of the specimens quoted.

- 13. Dæmonorops pseudomirabilis Becc. var. malayanus Furtado var. nov.
- D. periacanthus Miq. sensu Ridl. Mat. Fl. Malay. Pen. II (1907) 185 quoad specimen apud Chan Chu Kang lectum. Syn. nov.
- $D.\ pseudomirabilis$ Becc.? in Calc. Ann. XII (1911) 179, pl. 74. syn. nov.
- D. setigerus Ridl. Fl. Mal. Pen. V (1925) 45 quoad specimen apud Chan Chu Kang lectum. syn. nov.

A forma typica differt folioli costis utrinque lævibus; spadicis pedunculo ad margines obtusas aculeis vel tuberculis spiniferis prædito; spiculis minoribus (6–7 cm. longis); fructus squamis concoloris, badio-gramineis.

MALAY PENINSULA: Singapore, loc. incert. (Ridley, 3515. Type in Singapore; and 3507, v.n. Rotan Chochor); Chan Chu Kang (Ridley 3493). Johore, Gunong Pulai (Goodall, in April 1921).

D. pseudomirabilis Becc. was based on a specimen derived from a plant cultivated in the Botanic Gardens, Buitenzorg, where it was said to have been introduced from

Palembang. A duplicate specimen of the type of the variety here described was doubtfully referred to the species by Beccari with the remarks that he was not sure of the plant as represented by the specimen being wild in Singapore. Though Ridley omitted any reference to this species in his Flora V, I think I am justified in deducing from the manner Ridley labelled his collections in the Singapore herbarium that both the above cited specimens bearing no definite locality on their labels were derived from wild plants. Besides there is the evidence of the Chan Chu Kang and the Gunong Pulai specimens that the variety is really wild in the Peninsula.

The leaflets in this variety are not arranged in very distinct groups and though the lowermost 6-7 leaflets are approximate into a distinct group with 3-4 divergent leaflets on each side of the rachis, the upper leaflets are porrect (not divergent) and irregularly scattered, occasionally two leaflets coming very close together. The total number of leaflets as counted in one leaf (Ridley's n. 3493) are 18-20 on each side of the rachis. The outermost spathe is cymbiform abruptly contracted at the apex and covered with deciduous acicular spines produced on transverse ridges or At first sight the female spadix may be corrugations. confused with that of D. geniculatus, but the involucrophores and involucres of the latter are hollow or cupuliform at the apex, whereas they are truncate with very little marginal rim in D. pseudomirabilis var. malay-In this respect the spikelets of the last mentioned resemble those of D. longipes in which, however, the fruits are much longer than broad, the leaflets more regularly arranged and the leaf-sheaths without any annular rings.

14. Dæmonorops ruptilis Becc. Calc. Ann. XII (1911) 211, t. 97.

Daemonorops sp. Merrill in Univ. Californ. Publ. Bot. XV (1929) 24,

BRITISH NORTH BORNEO: Tawao in Elphinstone Province (Elmer, 20484; 20825; and 21873).

Merrill makes the following remarks on these three specimens: "Not matched in Beccari Herbarium, nor can I refer it to any of the species figured by him; probably an undescribed species."

I have examined the duplicates bearing the above numbers in the Singapore herbarium and do not find any grounds to separate them from *D. ruptilis*, though Elmer's specimens represent a stage a little more devoloped than the type figured in the above-mentioned plate.

15. Dæmonorops setigerus Ridl. Fl. Malay. Pen. V (1925) 45.

In the Materials II (1907) 185 Ridley had referred to D. periacanthus Miq. some specimens, giving one, at the same time, to understand that he was not wholly in agreement with Martius and Beccari regarding their interpretations of D. geniculatus and D. verticillaris. Beccari (Calc. Ann. XII, 1911, pp. 169, 189 & 200) pointed out that there were evidences to show that it was Ridley, rather than he and Martius, who was confused over the species and that D. periacanthus Miq. as interpreted by Ridley could not be Miquel's species, Ridley's species being of the group which bears decussating, membranous, spiniferous collars around But Ridley was not satisfied with the leaf-sheaths. Beccari's explanations and so in his Flora he not only adhered to his previous views regarding D. geniculatus and D. verticillaris but published a new binomial, D. setigerus, to include D. periacanthus Mig. sensu Ridley [Materials II, (1907) 187].

An inquiry into these three species has shown me that Beccari's views on D. geniculatus and D. verticillaris are correct and that D. setigerus Ridl. is an illegal binomial being a mixtum compositum. In spite of a definite statement by Griffith to the contrary, Ridley took D. geniculatus to be a species with an unarmed peduncle to the spadix, so that every specimen of *D. geniculatus* he saw with an armed peduncle (at times it is unarmed) is included by him under D. setigerus. Then he mistook female or neuter spadices of *D. verticillaris* for the male and on this belief he has transferred to *D. setigerus* most of the male specimens of D. verticillaris at his disposal and on this mixture he has based his description of D. setigerus. doubt he has included in his citations a specimen which I have referred to D. pseudomirabilis var. malayanus (described above), but the specific description does not in any way apply to it. The specimens quoted by Ridley under D. setigerus are as follows (I have not been able to trace two specimens cited under D. setigerus. Probably they are at Kew):-

(a) D. VERTICILLARIS (Griff.) Mart. Malacca, loc. incert. (Alvins, 1248, v.n. Rotan Gulang). Pahang, Kuala Lipis (Machado, 11632).

(b) D. GENICULATUS (Griff.) Mart. Malacca, Bukit Sandanan (Derry, 959 v.n. Rotan Kerai); Gunong Miring on Ophir (Ridley in 1892).

Perak, Assam Kumbang (Wray, 1922); Taiping Hills (Ridley, 11409); Bujong Malacca (Ridley 9813). Pahang, Tahan River, (Mat. in Sept. 1893).

(c) D. PSEUDOMIRABILIS var. MALAYANUS Furtado. Singapore, Chan Chu Kang (Ridley, 3493).

In addition there are several specimens from Johore and Singapore which Ridley has determined as this species, though they belong to *D. Kunstleri* and *D. periacanthus;* but apparently they were not cited in his works. Among them is one collected by him on Mount Austen, where the Sungei Tebrau has its origin and this may be the Sungei Tebrau specimen quoted under *D. setigerus*. The specimen represents *D. Kunstleri*.

16. Dæmonorops sparsiflorus Becc. in Rec. Bot. Surv. Ind. II (1902) 224 et Calc. Ann. XII (1911) 126, pl. 102 quoad spiculas floriferentes.

BRITISH NORTH BORNEO: Bole River, alt. 700 feet (Keith, 4325); Kinabalu Mountain Range: Dallas alt. 2,000-3,000 feet (Clemens 26888; 27012; 27216); Paluan

near Koung, alt. 1,500 feet (Carr 27377).

Keith's and Carr's specimens are male. Carr's specimen has spathes which are distinguished from the male of *D. sparsiflorus* var. *sarawakensis* Becc. by the fewer and much shorter, or rudimentary, bristles on the outside of their apex. The flowers in both the male specimens are somewhat spiral, or distichous in some parts and have a longer (up to 2 mm. long) distinctly pedicelliform involucrophore. The fruits in Clemens's specimens are very young, but they are sufficiently developed to show that the scales are arranged in 15 vertical rows. The involucrophore of the fruits is 5–7 mm. long, whereas in the *var. sarawakensis* it is only 3–4 mm. long even in fully developed fruits.

The species itself was based on a female specimen in flowers and owing to its apparent affinities to *D. draco*, Beccari had placed it among the *RESINIFERÆ*, and, though later Beccari described fruiting specimens of one of its varieties (*Calc. Ann. XII*, 1911, p. 221), he has not made any statement to show that the species and its variety are in fact non-resiniferous.

The species appears to be endemic in Borneo. No doubt the type of the species is Lobb's specimen said to have been collected in Labuan; but Lobb's specimens often bear incorrect localities.

16-A. Var. sarawakensis Becc. in Calc. Ann. XII (1911) 221 pl. 101 & 102.

BORNEO: Loc. incert. (Hewitt, v.n. Empunot); Kuching (Hewitt); Quop (Hewitt, n. P. 2, v.n. Rotan Landak); Gat near Upper Rejang River (Clemens 22089); Bau (Ridley 11824); Baram (Hewitt, n. R.E.).

In addition to its female flowers being distichously set, this variety, as pointed out above, differs from the type by the presence of many and much longer bristles at the apex of its primary spathes and by its shorter involucrophores in both the male and the female spadices. Apparently this form is more widely distributed than the type.

17. Dæmonorops vagans Becc. in Hook. f. Fl. Brit. Ind. VI (1893) 469 et in Calc. Ann. XII (1911) 153, t. 62; Ridl. Fl. Malay Pen. V (1925) 43.

D. periacanthus Miq. sensu Ridley in Journ. F.M.S. Mus. IV (1909) 87. syn. nov.

MALAY PENINSULA: Perak, Maxwell's Hill (Burkill & Haniff, 12646; 12716; 13192 & 13196); Taiping Hills (Fox in 1899). Pahang, Sungei Lemoi (Jaamat 28190, v.n. Rotan Kerei); Telom Ridge (Ridley, 13915).

The only character that distinguishes this species in herbarium from D. Kunstleri is the gibbosity on the petiole. As to the fruit-scales, only Fox's specimen was noticed to have them exactly in 15 longitudinal series. Haniff's 13192 has flowers only and so the number of vertical series in which the fruit-scales are arranged could not be ascertained. The fruits in Burkill & Haniff n. 13196 have the scales arranged in 15-17 series, while those of the other specimens have 18 series. The leaflets of this are usually narrower that in D. Kunstleri, but occasionally one comes across specimens of the latter species having similar, narrow leaflets. It has to be ascertained whether D. vagans represents only a form of D. Kunstleri at a very advanced age when, owing to the length of its stem, will have to depend more and more on the neighbouring trees for keeping itself erect. Such a condition may in the end contribute to the production of a gibbosity at the base of its petioles. Petioles with and without such gibbosity are described in D. elongatus.

I have not seen the Bornean specimen cited by Beccari (l.c. 1911, p. 153). Possibly it is a variety of D. elongatus.

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ALVINS: 1248=XV-a. BABJEE: 10168=X. BECCARI: 3644=X.

BURKILL: 928=VI.

Burkill & Haniff: 12646=XVII; 12681=VI; 12716, 13192 & 13196=XVII; 13450=VI; 16792= XII.

BURN-MURDOCH: 13297=VII-a.

CARR: 27377—XVI.

CLEMENS: Sn.—IX; 22089=XVI-A; 26793 & 26807—IX; 26888 & 27012=XVI; 27156 & 27156a=IX; 27216=XVI; 27269—IX; 29193 & 29194=IV; 30887=IX; 31280 & 31280a=IX; 31581=IX; 40754; 50343 & 50547—IX.

CORNER & FURTADO: 29482a & 29484=VIII; 29485 & 29486=II.

Curtis: sn.=VIIc; 2150=VII-c.

Derry: 959 = XV - b.

ELMER: 20482—VI; 20484 & 20825—XIV; 20840=IX obs; 21873—XIV.

Forbes: 2287-V in obs.

Forest Depart. Coll.—10209—X.

Fox: sn.=XVII.

GOODALL: sn.=XIII.

Goodenough: 1667 = VII-c.

GRIFFITH: sn. (?)—X & XII; 83=XII.

Hamid := 6380 - X.

HANIFF: sn.=VII-c; 14231—VI; 15911=VII-A.

HANIFF & NUR: 7119=VII-A.

HENDERSON: 24532=VI.

HEWITT: sn.=I, VI & XVI-A; P2=XVI-A; RE=XVI-A.

HOLTTUM: 9257 & 10610—VIIb; 10636—VIII obs; 10748—VIIb; 10839=VIIa; 10920=VIII; 21526—VII-a.

HUME: 8113=III.

JAAMAT: 28190—XVII. JUNAS: 16403—VI. KEITH: 4325—XVI. LAMBAK: 10006—X. LEWIS: sn.=XII obs.

MACHADO: 11632—XV-a. MAT: sn.:VI, VII & XV-b.

MOORHOUSE: sn.=X.

Nur: 7308—V; 11671 & 11835=VII-a; 12076—III; 12113—VI; 20045—VI.

OMAR: 9916 & 9933—XII.

RIDLEY: sn.=VI, VII, VIII, X, XI. obs. & XV-b; 3476—VI; 3493—XIII & XV-e; 3507—XIII; 3515—XIII; 5875—VI; 6273 & 6277—VI; 6285 & 6672—VI; 7885—VI; 7905—VII-b; 9813—XV-b; 10343—VII-b; 10345 & 10437—VI; 10783—X obs; 10952—X; 11409—XV-b; 11823—VI; 11824=XVI-A; 12395—I; 12408—VI; 12409—I; 13451—VII-a; 13915—XVII; 15361—VII-a; 15884—VII-A; 16291—VII-c.

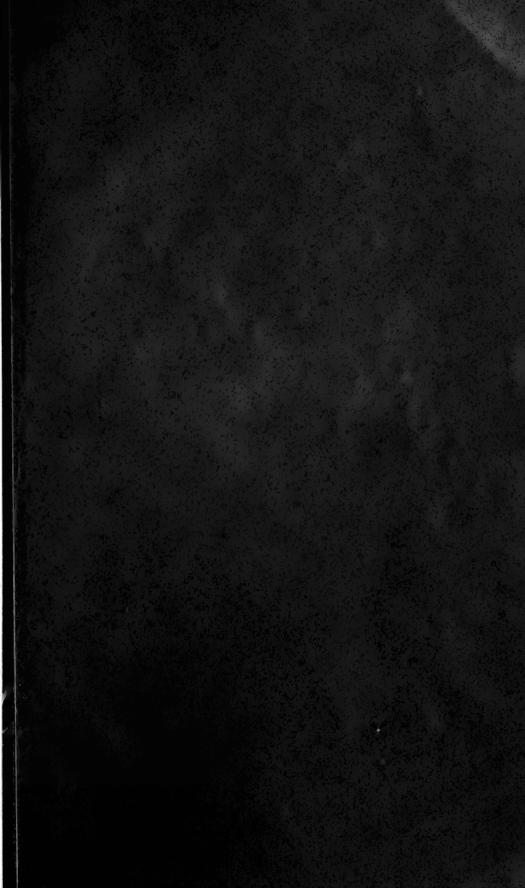
SAHIB: sn.=I.

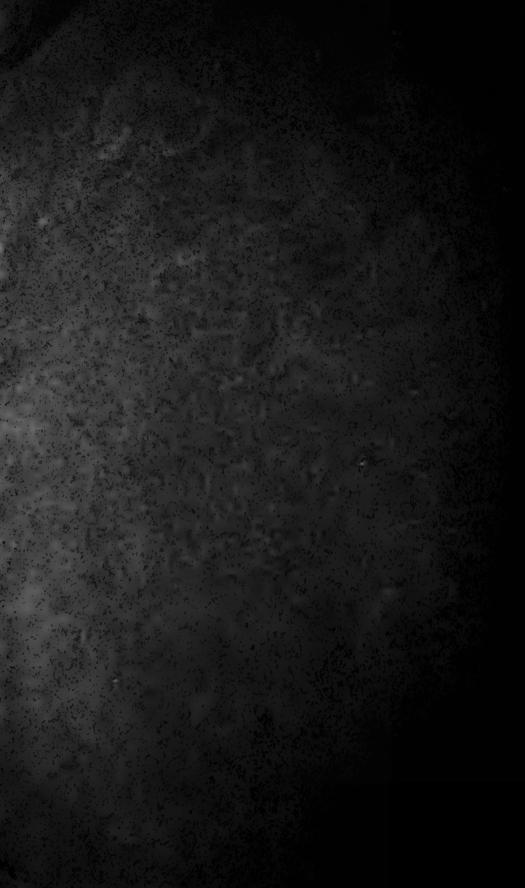
SCORTECHINI: sn.=XII.

SHELFORD: sn.—I. SMITH: 6701—X.

SYMINGTON: 24207—VI. VAUGHAN-STEVENS: sn.—X. WRAY: 1922—XV-b; 3658—III.







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